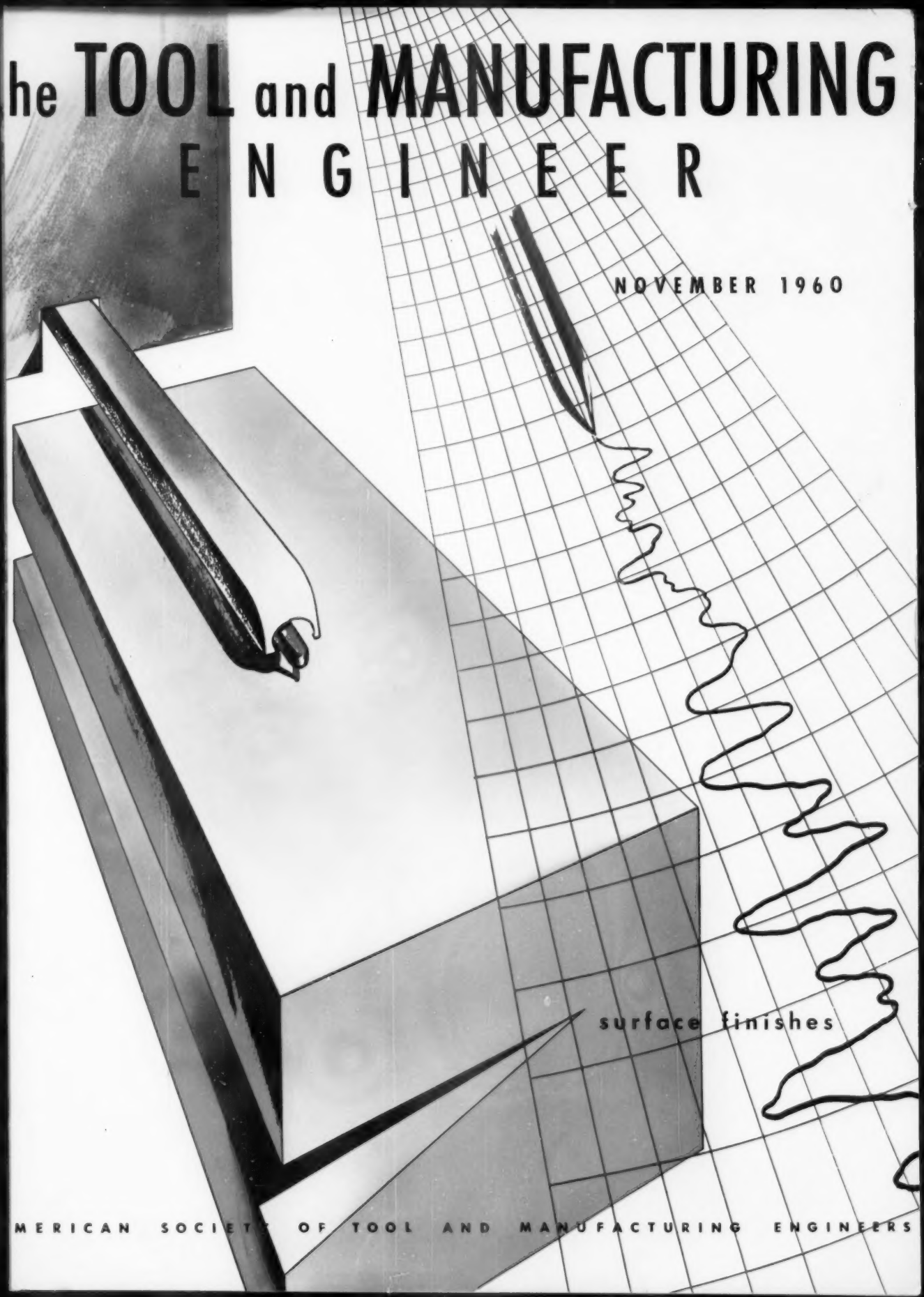
The TOOL and MANUFACTURING ENGINEER

NOVEMBER 1960



AMERICAN SOCIETY OF TOOL AND MANUFACTURING ENGINEERS

NEW Model 322-A Bore-Matic

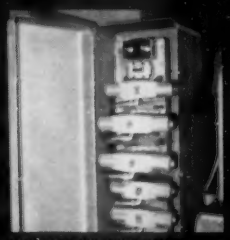
new industry-standard design provides

- ✓ HIGHER PRECISION
- ✓ EASIER SETUPS
- ✓ LOWER MAINTENANCE COSTS

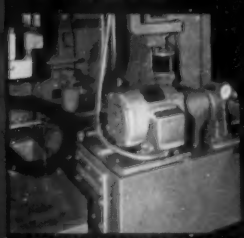




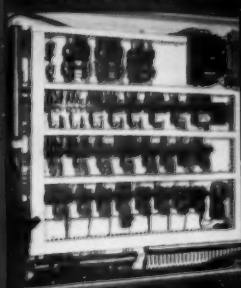
TABLE CAMS AND SWITCHES are e closed for protection yet easi accessible for adjustment.



STANDARD SOLENOID VALVES are e ternally mounted, oil immersed ar individually replaceable.



EXTERNAL HYDRAULIC POWER UN keeps accuracy-destroying heat o of the base, is readily accessibl and isolates pump and motor vibr tion from the machine.



ELECTRICAL CONTROLS are centra ized in an easily accessible dus tight cabinet at the rear of th machine.

Completely new from base to bridge, this double-end Bore-Matic meets all JIC standards—gives you new precision and economy for high production Borizing of medium to large size work.

Hydraulic valves and power unit are outside of the base, preventing thermal distortion, providing maximum accessibility and contributing to sustained high precision. Control valves, mounted on hydraulic manifold plates at each end of the machine, are of standard, interchangeable design, easily accessible and individually replaceable. Bridge setbacks are infinitely adjustable on slotted pads, permitting optimum relationship between work and tooling. And a full-length table pad increases the capacity of the machine.

For complete information on all the time-saving, labor-saving features of this versatile new machine, just call your Heald engineer, or send for Bulletin No: 2-322A.

PRECISION ROTARY INDEXING FIXTURE.

Shown on the machine above is a new electronically-controlled rotary indexing fixture, adjustable for any desired number of equally-spaced indexes from 4 to 500,000, permitting precision drilling or boring of accurately-spaced holes on one or more bolt circles. Holes with the same spacing are Borized in a fully automatic cycle, resetting the controls only when spacing is changed.

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the TOOL and MANUFACTURING ENGINEER

Volume 45
No. 5

November
1960

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Tooling up "by the book" does not always give optimum efficiency. A combination of theory, experience and experimentation is needed.

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Machinable Carbides Solve Wear Problem ..... *By J. L. Ellis and S. Tarkan* 99
Dies and wear parts of a new family of carbides can be machined on standard toolroom equipment, then heat-treated for maximum hardness.

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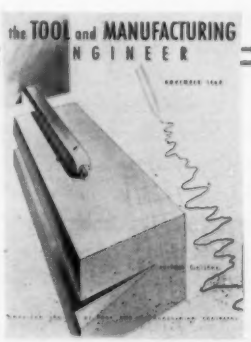
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THIS MONTH'S COVER

As the stylus of a surface roughness measuring instrument is drawn along a workpiece, a profile of the surface—greatly magnified—is recorded on a chart. Production tolerances have tightened during the past few years and these instruments have come into general use. Equally important to manufacturing planners is obtaining an estimate of surface roughness produced by various processes. A quick method is described in the article starting on page 81.



THE TOOL AND MANUFACTURING ENGINEER is regularly indexed in the *Engineering Index Service* and *Applied Science & Technology Index*, used generally in libraries. The magazine is available in microfilm form at moderate cost.



Electronic parts courtesy Judson Mfg. Co., Inc., Cornwells Heights, Pa.

Mirror-bright without polishing, after switch to Sunicut

Boring on a multiple-spindle automatic produced the finish you see on these electronic parts. Sunicut 102-S Cutting Oil saved time and money by eliminating the polishing operation. The same automatic uses Sunicut 102-S to machine metals ranging from titanium to stainless 410.

Sunicut 102-S is one of a full line of cutting oils known throughout metalworking for maintaining long tool life, close tolerances, and fine finishes. There's a grade of Sunicut that can help you improve your product quality—and *that's* the best economy of all.

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On the Menu Today

Today, mother and dad are informed about the lunch menu that Johnny is being served in the high school cafeteria. This has become the subject of a morning newscast in a midwestern city. Parents, however, are becoming shocked when they awaken to the realization they know more about son's gastronomic fare than about his mental menus. Except for occasional and unrelated questions about homework most fathers and mothers hear little about the mental menus in our schools.

This lack of communication is a basic weakness no matter where the fault lies. It is probably most serious at the high school level because there the die is cast for the future course in education. Whether Johnny becomes an engineer or scientist or another professional specialist depends upon many factors, some of which are influenced by inspirations received in high school classes.

One of the most important needs of a democracy is an educated citizenry. It exceeds in importance all but a few basic essentials. For this reason the educational system should be of major concern to every individual in the nation.

Interest must extend beyond a willingness to give the system financial support. It should include an eagerness to know the purpose and intent of the school system. Knowledge of the curriculum content is necessary at various grade levels as well as an understanding of student-teacher relationship. A parent should study ways to improve the basic contact between the system and student.

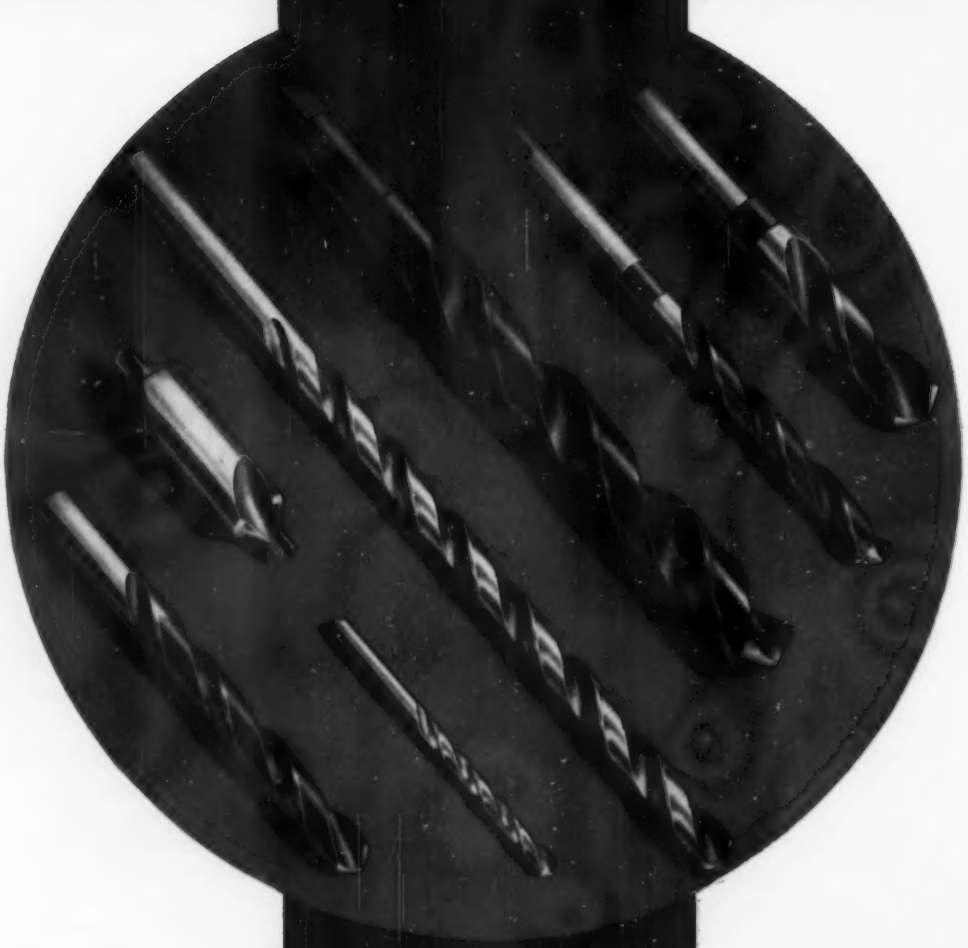
Although tool and manufacturing engineers have many problems during the working day—some of which are taken home for solution at night—he must remember his investment in the future. This requires an active interest in academic enterprises, the foundation upon which our future and security lie.

John W Greve

EDITOR

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*Patent No. RE. 24,572





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Stocked in all popular tap sizes, 'Rocket' Taps are available in both plug and bottoming styles from your local Winter Distributor. Call him today for complete information on this newest, cost-cutting tool from Winter Brothers. Or, write for our free, informative brochure on 'Rocket' tapping.

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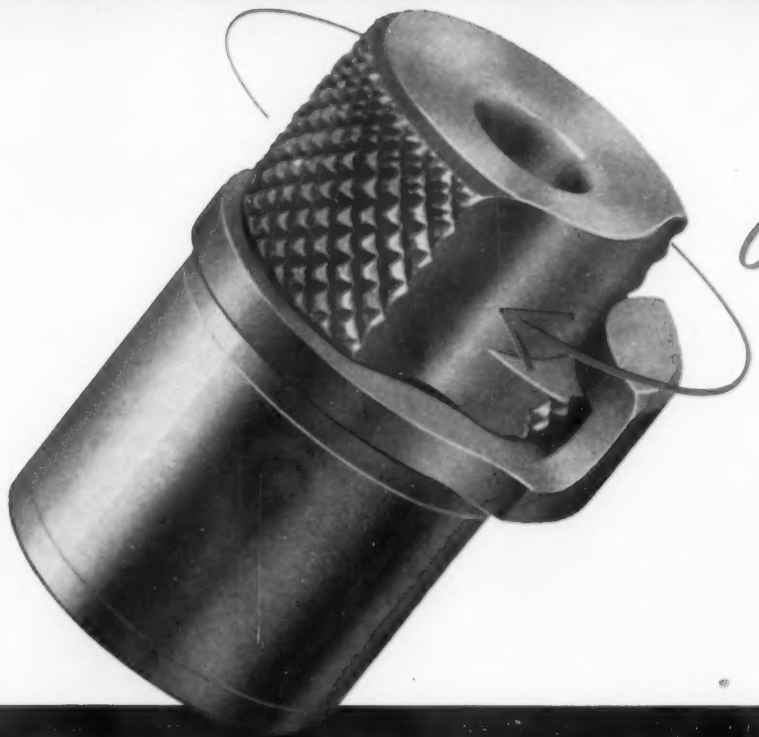


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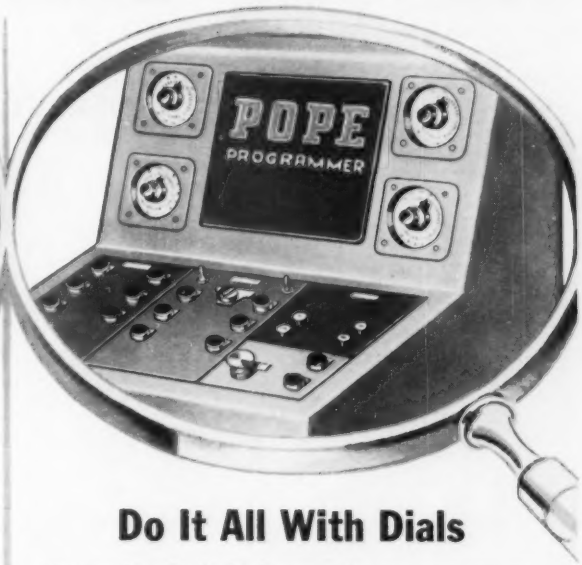
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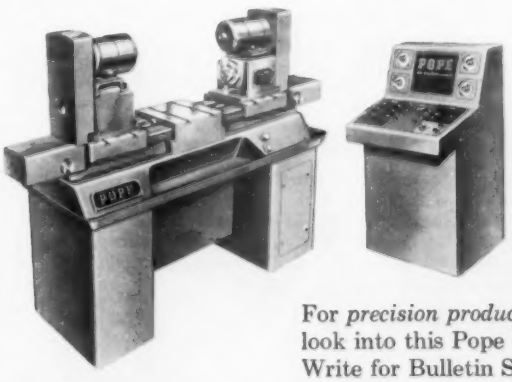
and of course you can have more than one spindle in each head. The Pope Model 10-6 features *two precision boring heads** operating completely independently of each other to provide simultaneous or alternate cycling movement of the heads. *This means increased production.*

*The Pope Boring Head Spindles on this machine revolve within 20 Millionths.

Do It All With Dials

Automatic cycles for boring operation sequences are programmed on these dials. The operator simply determines the sequence of operations and dials each one. You get continuous production of uniform parts in less time.

The Pope Electric Programmer gives you finger-tip fast control of infinitely variable speed, distance and operating sequence. You dial in the complete program with ease and speed that beats expensive numerical or tape control. Supreme accuracy is maintained for cycle after cycle.





No. 132

For *precision production at a profit* look into this Pope Model 10-6. Write for Bulletin S-21.

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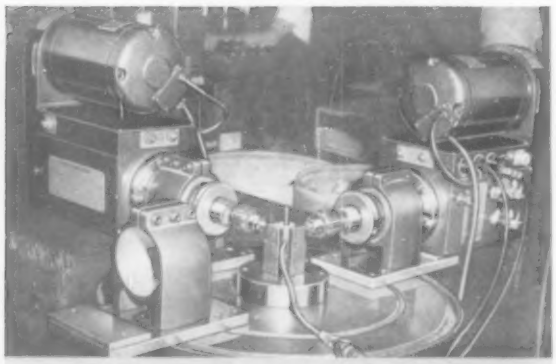
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Hughes two-axis control system, with positioning table, can be retrofit to almost any kind of drilling machine—single or multiple spindle—or to any other type machine requiring two-axis positioning.

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To find out more about how Hughes numerical controls can increase your profits, write, teletype (TWX INGL 4117) or call collect: Hughes Industrial Systems Division, P.O. Box 90904, International Airport Station, Los Angeles 45, California. For export information, please write: Hughes International, Culver City, California.

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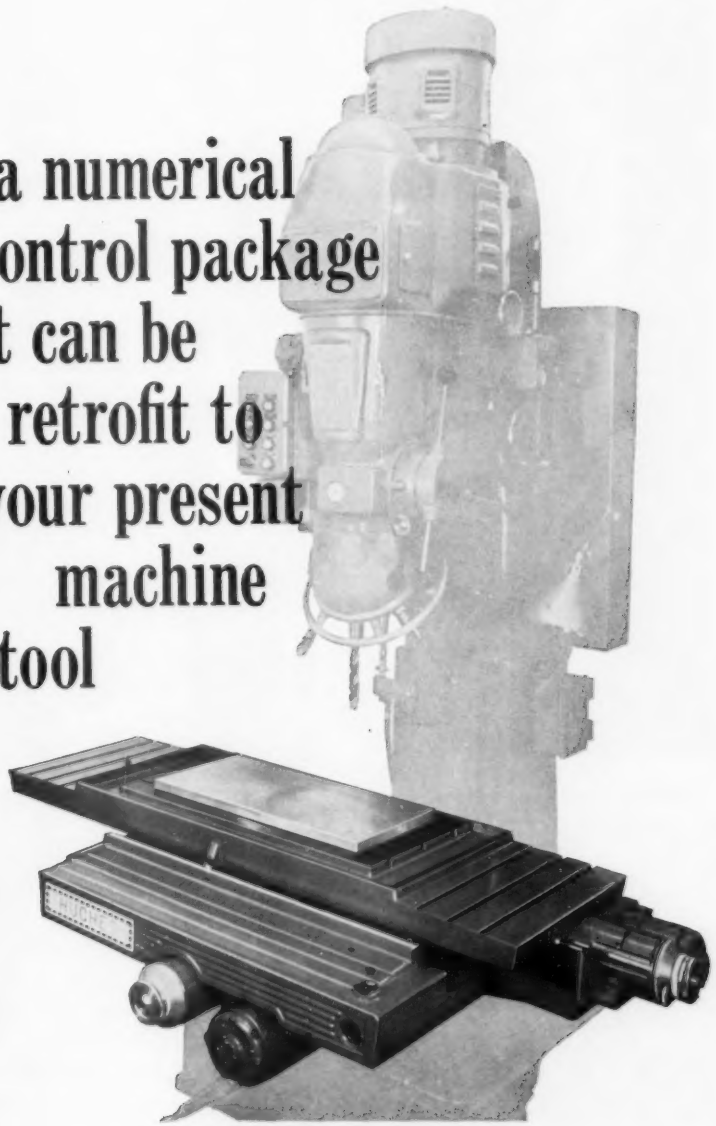
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INDUSTRIAL SYSTEMS DIVISION

HUGHES AIRCRAFT COMPANY

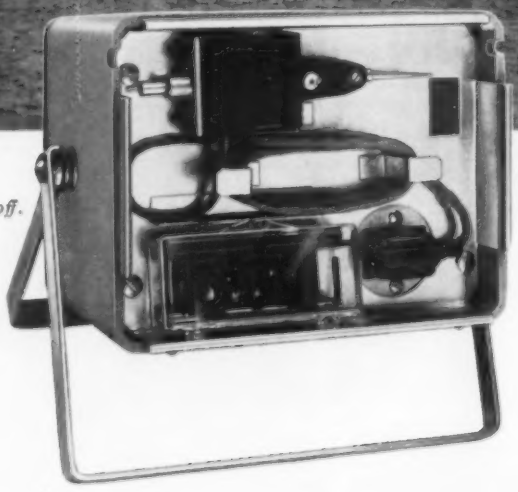
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NEW, Improved electro-probe . .





Rear view with cover off.



NEW CONVENIENT PACKAGING Housing of amplifier is carrying case for gage. Gage head can be removed and mounted without disturbing plug connection, and cover replaced while head is in use. Battery beneath panel is easily removed. The small plastic box contains holding and mounting accessories.

• • LOW COST PORTABLE ELECTRONIC GAGING UNIT

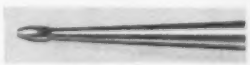
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Many new features.

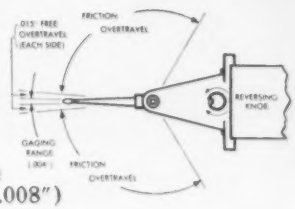
FEATHER-LIGHT TOUCH Extremely low contact pressure — less than 2.5 grams — so light you can gage dependably to high accuracies in the shop without using heavy weight stands. Electro-probe can be used with test set stands or even more conveniently with new, low cost, wide range height stand illustrated.

UNIFORM GAGING PRESSURE Unique gage head design permits constant pressure throughout range (change is less than 0.1 gram per .001″ of contact travel in either direction). Pivot located so that *magnification remains constant* with changes in contact position.

NEW

NEW CONTACT TIP DESIGN (Patent applied for) New involute curve form of tip permits accurate measurements, even with finger at 20° angle to work. No need to apply correction factors as with other lever-type gage heads.





NEW

WIDE CHOICE OF GAGE HEAD POSITIONS Contact can be positioned anywhere within arc of over 200° and is clutch-mounted for complete overtravel protection. Small tip on contact lets you check where other electronic gages cannot.

NEW

DUAL RANGE ZERO ADJUSTMENT Two-speed knob provides unique arrangement for both long range electrical zero adjustment (over .008″) and fine setting. Simplifies set-up and makes precise mechanical positioning unnecessary. Each Electro-probe has two ranges (± .002″ and ± .001″ for one model and ± .001″ and ± .0002″ for the other). Other magnifications available. Scales are correlated; zero setting will not change when switching magnification.

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BATTERY LIFE QUADRUPLED New transistor amplifier design gets 1200 to 1300 hours' life from mercury cell battery (up to 2 years' operation in normal use) — more than four times that obtained by previous model. Can also be operated from pen size mercury cells or . . . in emergency . . . regular carbon-type batteries. Where use is continuous, a battery eliminator can be furnished for 115 volt operation.

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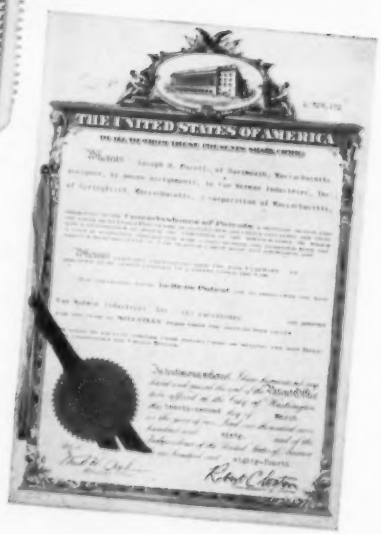
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Patent No. 2929172 granted March 22, 1960. 2676



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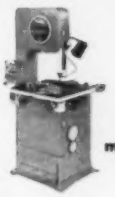
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16¢

Accurate high-speed filing work

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Here are hourly "wage rates" for just 16 of many DoALL machine tools. It shows you the extremely low cost of putting their great earning power to work in your plant without capital expenditure. Their high productive capacity can earn as much as ten times their "wage rate." Put DoALL machine tools on your payroll to reduce manufacturing costs. There is a best machine for every job. Use convenient coupon below.

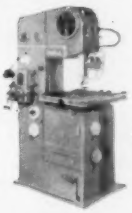
CONTOUR-MATIC* 3



$1.76

Fixturable table power feed uses HSS saw bands

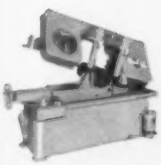
CONTOUR MACHINE 4



51¢

For contour sawing, filing polishing

POWER SAW 5



41¢

For hand-operated cut-off work

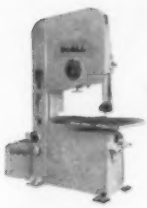
LAPPING MACHINE 6



71¢

Ultraprecision dimension finishing

ZEPHYR MACHINE 7



89¢

High-speed and friction sawing

POWER SAW 8

Automatic heavy-duty cut-off work

$1.44



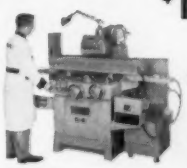
SURFACE GRINDER 9



33¢

Precision manual operation

SURFACE GRINDER 10



$1.28

Production precision automatic operation

BAND MILL 11

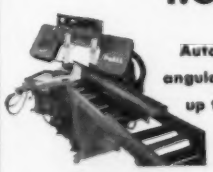
$5.13



For slabbing shanking refacing

ANGLE POWER SAW 12

$1.65



Automatic angular cuts up to 45°

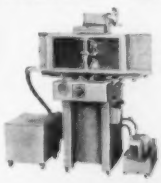
I/D MICRO-SLICER 13



$1.80

Automatic precision slicing semiconductors

MICROTOM-ATIC* 14

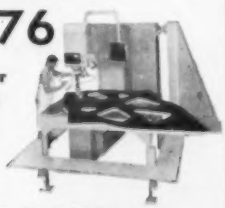


61¢

Manual precision slicing and dicing

PAN-ARM* SAW 15

$7.76



Contour cutting huge parts

*Reg. T.M.—The DoALL Company

CONTINENTAL PRODUCTION SAW 16

$2.40

For continuous heavy-duty cut-off work T. carbide saw bands



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B-55

THE DoALL COMPANY Des Plaines, Ill.

We want more information on the machines checked HERE:

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WORK-HOLDING BY WOODWORTH



WOODWORTH ARBORS ASSURE TRUE CONCENTRICITY AT HARTZELL



DAVID BIERMANN

● **DAVID BIERMANN,** *Vice President and General Manager of Hartzell Propeller, Inc., Piqua, Ohio, regards Woodworth work-holding performance as outstanding on several difficult machining operations at Hartzell. Citing just one example of superior chucking, Mr. Biermann explained the job pictured above, "On this blade turning operation, we had a problem of holding concentricity between the bore and the O.D. of the blade shank, also excessive set-up time slowed production when changing from one blade size to another. With WOODWORTH'S "TORK-LOK" ARBOR, we maintain .0005 T.I.R. concentricity and have cut set-up time from a previous 45 minutes down to 3 minutes or less!*

"Hartzell's motto is 'BUILT ON HONOR' and precision tools such as Woodworth's equipment help us maintain our position as the leading producers of aircraft propellers for light plane industry."

● Woodworth sales engineer, Robert Diedrich, is shown above with machine operator Paul Manson at Hartzell Propeller. The turning operation pictured is performed on a Monarch 18″ lathe. The shank of the aluminum propeller blade is formed using WOODWORTH'S "TORK-LOK" COLLET ARBOR for holding, and no tailstock is necessary. From a rough diameter of 4.500″ the shank is turned to 4.193″, ±.001″. Woodworth's arbor replaced an expanding mandril which was previously used for short runs on this machine.



WRITE FOR ARBOR CATALOG 3-58

When You Buy, Specify

ACCURACY YOU CAN TRUST

WOODWORTH

1300 EAST NINE MILE ROAD • DETROIT 20, MICHIGAN

PRODUCTION POINTERS from GISHOLT

More cost-cutting IDEAS– to help you

HOW IHC SUPERFINISHES BEARING RACES 300% FASTER

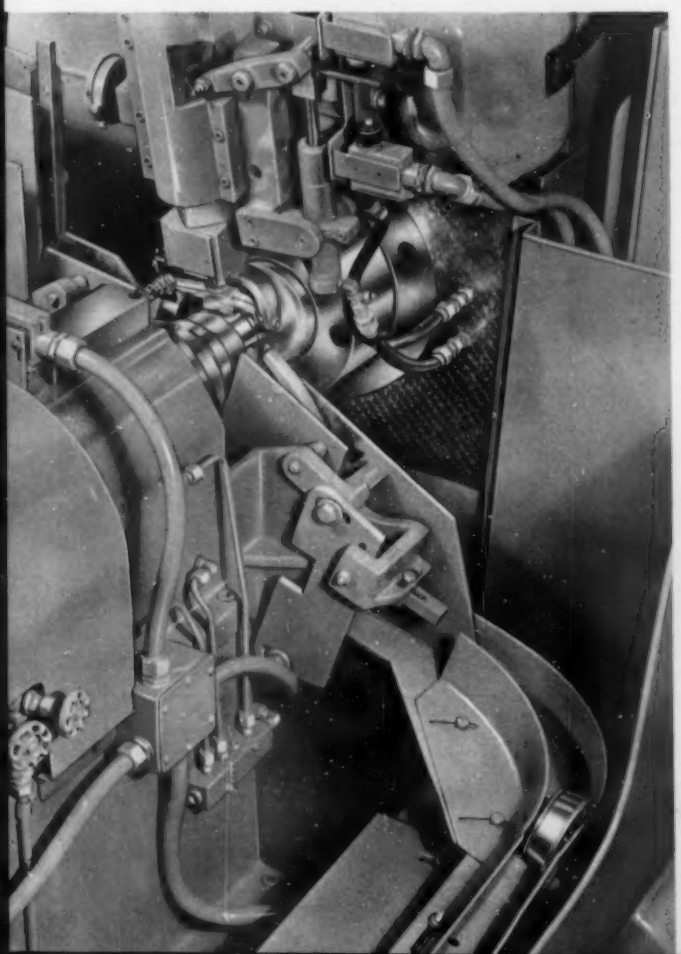
Superfinisher® with automatic work handling cuts time, improves quality

Here is an excellent example of how new equipment, properly applied, offers dramatic cost and time savings. In use at International Harvester's West Pullman Works, Chicago, Illinois, this Gisholt Model 79A Bearing Race Superfinisher handles tapered inner bearing track surfaces on a wide variety of inner bearing races, 2½" to a maximum O.D. of 4¾".

Here is the operation on an inner bearing race with a 12° taper and a 2⅜" bore. Ground parts are placed in a gravity loader. A pocket wheel indexes the work to chucking position. The tailstock moves the part over an arbor for chucking in the I.D. The Superfinishing stone engages the outer track surface. At the end of the automatic cycle, the stone and tailstock retract, and spring-loaded pins eject the part. The pocket wheel indexes a new workpiece into position, at the same time discharging the finished part. F.t.f. time, 10 sec.

Different part sizes are accommodated by adjustment of loader tracks and replacement of the pocket wheel, arbor sleeve and Superfinishing stone. The quill is adjusted for angle and diameter. Separate sets of dial controls adjust spindle speed, stone pressure, reciprocation rate and stone contact time.

Superfinishing eliminates one grinding pass, provides better surface faster. Former methods required two grinding passes—the second to bring the surface from 60 to 25 micro-inches RMS in 25 sec. Next the races were Superfinished to 8 micro-inches RMS in 30 sec. Now the races are Superfinished from 60 to 8 micro-inches RMS in only 10 sec.



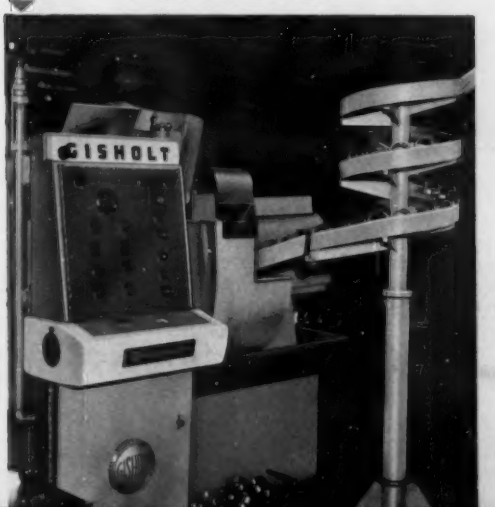
View from rear of machine showing Superfinishing stone engaging workpiece and Superfinished part in discharge conveyor.

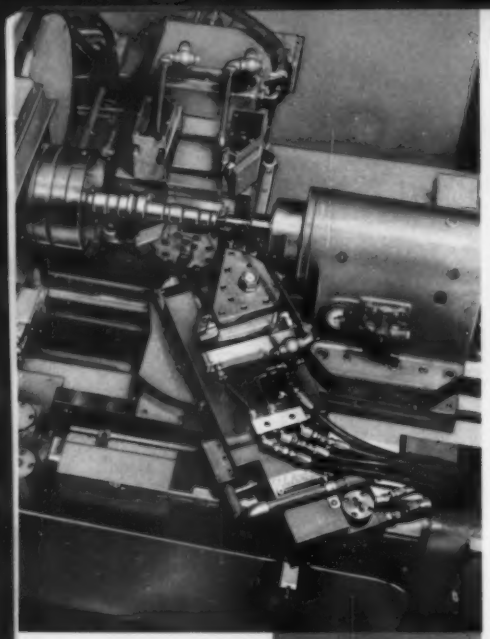


Rough workpiece at top. Superfinished part at bottom has a "controlled" 8 micro-inch RMS finish after fast, 10-sec. Superfinishing operation.

For information on Superfinishers circle or write in No. 736 on inquiry card.

MASTERLINE® 79A Bearing Race Superfinisher. Note dial controls at left which govern basic machine functions and speed setup. Gravity loader holds number of rough parts. Full automatic operation frees operator to handle additional units or perform other work.







JETracer, operating within automatic cycle of No. 12 Automatic Production Lathe, makes short work of stepped shaft job. Second operation shown. The JETracer handles the stepped diameters and contours, using four different templates for each operation. Necking, grooving and chamfering are completed from the rear independent slide.

For information on JETracing, circle or write in No. 737 on inquiry card.

EASY WAY TO HANDLE STEP SHAFTS

Speeds setup, reduces inspection, cuts tool costs

Step shaft jobs couldn't be easier when you've got a No. 12 Automatic Production Lathe with a multiple-pass JETracer® operating within the automatic cycle.

All the work on the step shaft shown (12⅝" x 2¾") in the setup photo is completed in just two 4-pass operations.

Operation 1, on one end, takes just 5.0 min., f.t.f. Operation 2, shown — only 4.9 min., f.t.f.

The JETracer, mounted on the front carriage, has a 4-pass automatic indexing template carrier. An automatic indexing tool post on the JETracer slide presents a roughing tool on the first three passes, then a finishing tool on the final pass.

To handle similar parts requires only a change of tracing templates and grooving tools, and chamfer tool adjustments. Many shaft jobs may be completed in just two passes for each end. With such a setup, four templates would be used and the work turned end-for-end after the second pass. The entire part could then be completed in one machining cycle—eliminating the need for the banking of parts.

Rigidity and automatic cycle of No. 12 Automatic, combined with efficiency of multiple-pass JETracing, assure accuracy and economy.

UNIQUE AR® ADVANTAGES BOOST SMALL-LOT EFFICIENCY

Setup demonstrates combination of advantages offered for first time in ONE machine

Now for the first time the No. 5 AR Turret Lathe gives you the efficiency and consistent accuracy of automatic cycling, plus the versatility and quick setup of a hand-operated ram type turret lathe. And it handles BOTH BAR AND CHUCKING WORK. Take this 1" valve bonnet job, for



example. First operation (A) is a bar job; second (B), a chucking job. While both operations could easily be done on one AR—converting from bar to chucking in one hour or less—the volume of work here warrants the use of two AR's: one for bar work, the other for chucking.

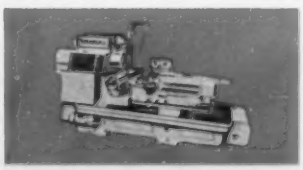
All external and internal surfaces in area A are machined in the first operation in only 3.3 min., f.t.f. An Air-draulic bar feed allows feeding of the 2½" bar stock right up to the collet pads.

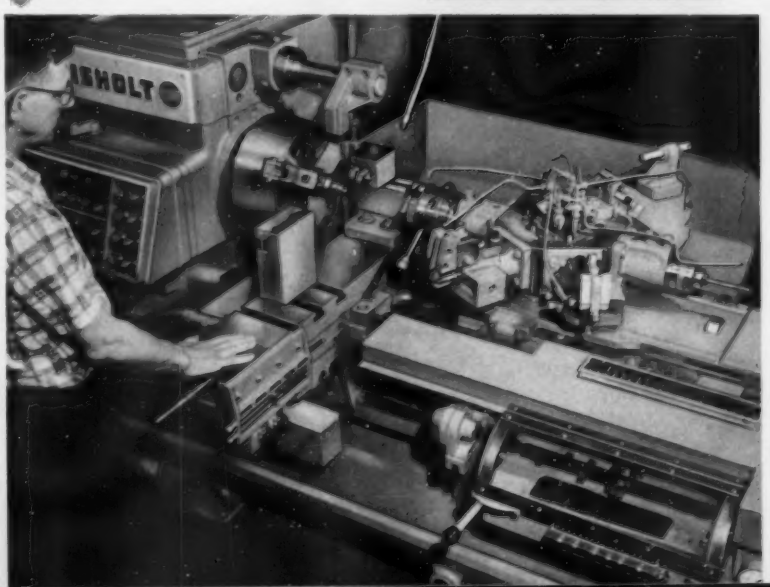
Tooling for the second operation (chucking) is shown. All internal and external surfaces in area B are completed in only 2.1 min., f.t.f. Operations handled during the automatic cycle include: deep hole drilling with automatic chip clearing; internal and external threading; internal recessing; dwell for cleanup, and reverse feed for fine finish. Many of these operations would require a highly skilled operator if done on a hand-operated machine.

One operator easily handles two AR's—one for bar work, the other for chucking work. He keeps bar stock supplied on one, chucks and unchucks on the other, and removes finished parts.

AR (Automatic Ram) Turret Lathe averages 50% boost in productivity—extends tool life—assures consistent, close-tolerance quality.

For information on AR, circle or write in No. 738 on inquiry card.





AUTOMATIC 10-STEP BALANCING ELIMINATES CHANCE OF HUMAN ERROR

Cycle includes measurement and location of unbalance, correction and inspection



Gisholt Automatic 2U Balancer setup measures amount and locates angle of unbalance in each of two correction planes, corrects by drilling, and inspects for balance in one, 100-second, automatic cycle. Note multiple-spindle correction drilling units to right of operator. Operator loads and unloads, couples and uncouples the drive.

Perhaps you can take advantage of the principles involved in this automatic balancing setup used by a well-known automotive manufacturer. Here two automatic Gisholt 2U Balancing Machines are an integral part of the crankshaft machining line.

Each machine is furnished with a ring (bob) weight eliminator, which offers considerable savings in tooling costs and work-preparation time—and two Leland Gifford multiple-spindle drilling units.

The crankshafts are manually loaded and unloaded. Balancing machine operation is completely automatic. In one continuous cycle it measures the amount and location of unbalance in each of two correction planes. It indexes to the exact angles for correction drilling and then inspects to assure balance within the ½ ounce inch tolerance.

If unbalance exceeds the maximum correction that can be made in one drilling, if unbalance falls outside the sectors in which correction can be made, or if residual unbalance exceeds tolerance, the machine stops and a signal light goes on.

A manual operation switch then permits the operator to reinspect the workpiece and make the necessary balancing correction.

The entire automatic sequence can be completed for the average part in 100 seconds, so the operator has ample time to handle two machines.

Ten operations for locating, measuring, correcting and inspecting for balance are quickly performed in one automatic cycle—eliminating human error, assuring that balancing tolerances are uniformly met on every part.

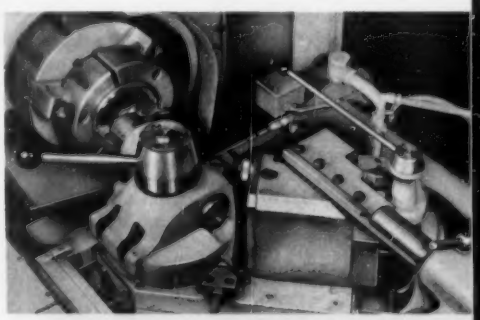
For information on balancing machines, circle or write in No. 739 on inquiry card.

NOW CRI-DAN OFFERS TRACING AND THREADING TO CUT YOUR COSTS

Single-point ceramic tracing and carbide threading operations combined in automatic cycle for top efficiency

This part, an accumulator cap of 1040 steel, was previously rough- and finish-machined, and then threaded, using collapsible die heads. It is produced in two different sizes. The manufacturer wanted to eliminate problems of holding size and meeting fine surface finish requirements. He also wanted to combine machining and threading on an automatic, and reduce tool, die and setup costs.

The answer, provided by a CRI-DAN E Automatic Threading Lathe, may help you in your own work. The illustrations and captions tell how the CRI-DAN handles contour-tracing and threading far faster than by previous methods.



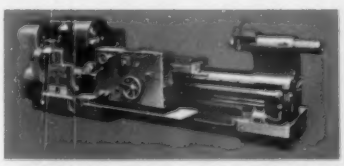
The part shown, 6¼″ diameter, 4⅛″ long, arrives at CRI-DAN rough-machined. It is held in special jaws to eliminate distortion. A triangular insert-type ceramic tracing tool is used, starting at the face, to face, chamfer, bore I.D., under-cut thread relief, bore seal diameter and face bottom of seal diameter. A machining speed of 700 to 800 s.f.m. produces a 50 micro-inch RMS finish on all surfaces. Triangular inserts provide six cutting edges with 12 pieces completed per edge.



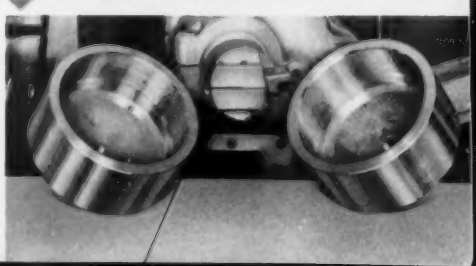
The 1.450″-long, 5.375″-diameter, 16 NS-2B thread in the bore is then completed in 12 passes (.0015″ in feed per pass) by the single-point carbide threading tool. Note that both the tracing and the threading tools are mounted in the same holder. The thread is machined from the right-hand side of the part—starting at the base of the bore and feeding out to the face of the work.

CRI-DAN E cuts time—combines tough internal contour-tracing and threading jobs in automatic cycle. Change-over for two part sizes takes approximately 15 min.

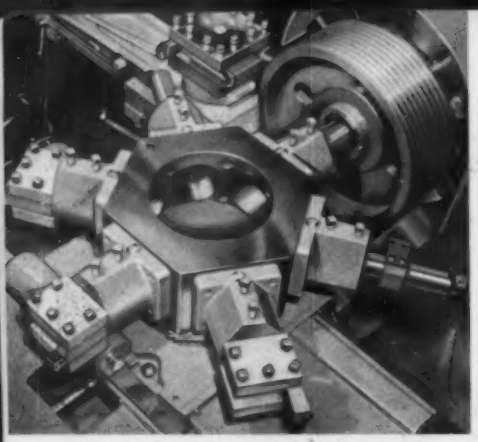
For information on CRI-DAN E, circle or write in No. 740 on inquiry card.



Close-up of the work and tooling. At right: ceramic threading tool and part showing surfaces traced. At left: carbide threading tool and thread produced in 12 passes.



ASK YOUR GISHOLT REPRESENTATIVE ABOUT FACTORY-REBUILT MACHINES WITH NEW MACHINE GUARANTEE



First operation setup. Cross-feeding hex turret tools bore, turn, recess, face, chamfer and groove I.D. Square turret tools turn O.D., face, chamfer and single-tool the V-belt grooves. Time, 73.9 min., f.t.f. Second operation is the same as the first except for grooving and boring. Time, 33.4 min., f.t.f. One set of tools handles both operations. Reversible chuck jaws speed change-over.



CROSS-FEEDING HEXAGON TURRET CUTS SMALL-LOT TOOLING COSTS

Full-swing side carriage permits handling larger work on less costly machine

Two important cost-cutting advantages are obtained by this setup on a Gisholt MASTERLINE 3L Saddle Type Turret Lathe:

1. A cross-feeding hexagon turret cuts tooling costs and reduces setup time for short-run work;
2. A full-swing side carriage (standard) permits swinging work up to 21¼″ diameter over the cross slide on the less costly 3L size machine.

You'll want to remember the way these advantages are used to machine 20¾″ diameter, 7″-wide cast iron V-belt pulleys in two operations.

Standard boring bars and cutter holders are mounted on the cross-feeding hex turret. These are used to bore, turn, face, recess, chamfer and groove I.D. *One* set of tools is used for *both* operations. A 6-position stop roll for the cross-feeding hex turret assures repeat accuracy on all cuts.

The full-swing side carriage permits moving the cross slide right up beside the almost maximum diameter part as square turret tools turn the O.D., face, chamfer, and machine the V-belt grooves. The nine grooves are single-tooled to eliminate distortion and provide a fine finish. The side carriage stop bar has special notches that assure accurate spacing of grooves with minimum operator effort.

Cross-feeding hex turret allows standard tools to handle multiple operations. With a taper attachment or JETracer control, even greater versatility can be obtained at minimum cost.

For information on saddle type turret lathes, circle or write in No. 741 on inquiry card.

ONE TAPE-CONTROLLED FASTERMATIC® OUTRUNS SIX OLDER MACHINES

Cuts f.t.f. time 85%, cuts setup time 68%, assures consistent accuracy

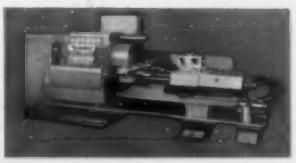
Imagine the savings on your short-run jobs with a setup like this in your shop. It combines the automatic cycle of a versatile Fastermatic Automatic Chucking Turret Lathe with the fast setup and small-lot flexibility of point-to-point, punched-tape PRODAC control. Westinghouse Corp., Motor and Control Division, Buffalo, New York, is the user.

Here the operator sets his tools, inserts the tape in the reader, takes his trial cuts, makes his final tool adjustments, and starts the automatic cycle. Hand setting of stops and trip dogs, and selection of spindle speeds, feed rates and machine functions, are eliminated—all having been programmed on the tape.

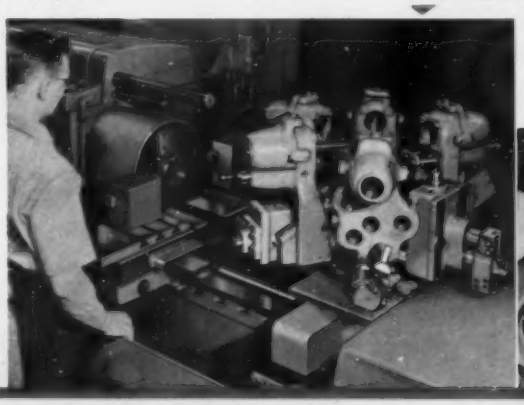
The tape-controlled Fastermatic used by Westinghouse handles a great variety of work formerly requiring six machines. Consistent production rates, long tool life and uniform quality are important benefits.

IF Fastermatic, with point-to-point punched-tape control, outproduces six older machines on variety of small-lot work. Engineering department has complete control; operator-influenced variables are eliminated.

For information on punched-tape PRODAC-controlled Fastermatic, write in or circle No. 742 on inquiry card.



Setup used by Westinghouse for machining two sides of nodular iron commutator V-rings, 4½″ diameter, 1⅜″ wide. Point-to-point, punched-tape PRODAC-controlled Fastermatic cuts previous setup time 68%, cuts f.t.f. time 85%. (Below) Rough ring and both sides of finished part. One side machined from hex turret stations 1 and 2, and front cross slide. Other side handled from stations 3 to 6, and rear cross slide. Total f.t.f. time, just 4¼ min.





GISHOLT

MACHINE COMPANY

Madison 10, Wisconsin, U.S.A.

The Gisholt Round Table represents the collective experience of specialists in the machining, surface-finishing and balancing of round and partly round parts. Your problems are welcomed here.



No. 11-1260
769

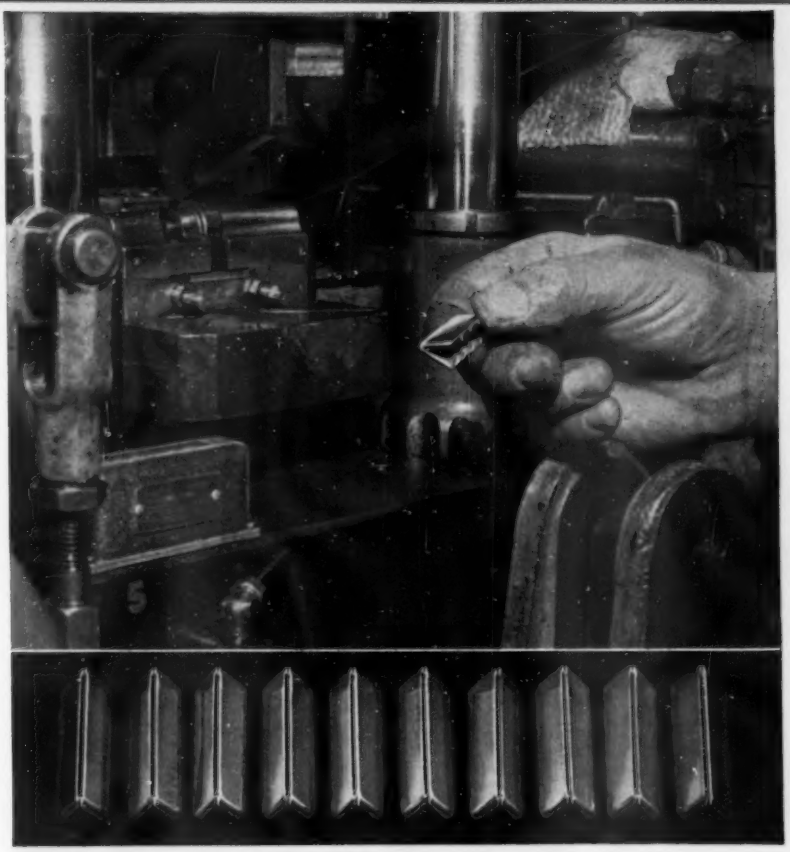
Turret Lathes • Automatic Lathes • Balancers • Superfinishers

Threading Lathes • Packaging Machines • Masterglas Molded Plastic Products

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Tool Steel Topics

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.



Lehigh H blanks and forms 1,000,000 pieces before redressing is necessary

Using a die of Bethlehem Lehigh H tool steel, Sobel Metal Products Co., Easton, Pa., produced this nickel-silver belt accessory, of the type used with army uniforms, at the rate of about 1,000,000 pieces before redressing was necessary. Blanking and forming .020-in. metal, the die was hardened to Rockwell C60-61. One of the requirements of the order was that no marking was permitted on the finished part.

Lehigh H (AISI D-2) is excellent tool steel for jobs like this. Not only is it the leader in machinability among the high-carbon, high-chromium tool steels sold today — it also has improved wear-resistance because its vanadium content has been increased to 1 pct.

As the result of a new manufacturing process, Lehigh H has improved carbide distribution and increased center density. It also has minimum distortion during heat-treatment.

If you want unexcelled machinability, excellent wear-resistance, and plenty of dependability, Lehigh H is your answer. See your Bethlehem tool steel distributor for prompt delivery.

Use Reader Service Card, CIRCLE 20

BETHLEHEM TOOL STEEL ENGINEER SAYS:

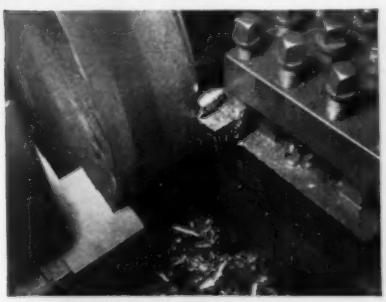


Blind Holes Can Cause Plenty of Trouble

Unless one uses great care, blind holes can cause a lot of trouble when heat-treating tools. Holes for studs or dowel pins are typical of the blind holes which, as a rule, are paid little attention. Exposing blind holes to liquid quenching produces extremely high internal stresses, which can lead to cracking of the tool, either during heat-treatment or in service.

If it is not necessary for blind holes to be hard internally, these difficulties can be avoided by packing the holes prior to the quench, using clay, asbestos rope, steel wool, or a steel plug.

Blind holes are particularly objectionable if they must be uniformly hard on the inside surface. The only way to meet this requirement consistently is to select a grade of air-hardening tool steel.



Be Sure to Try Red Sabre Tool Bits

You're sure of economical cutting when you use Bethlehem Red Sabre Tool Bits, regardless of the type of application. Red Sabre is a super high-speed steel, with about 1.50 carbon, 12.00 tungsten, 5.00 vanadium, and 5.00 cobalt. The bits have high red-hardness and uniform hardness all the way through, for peak resistance to wear and maximum cutting ability. They come hardened to Rockwell C65.

Use Reader Service Card, CIRCLE 21

New

RED RING MACHINE SHAVES LARGE GEARS FASTER . . . MORE EFFECTIVELY



Table in shaving position

Significant design innovations in the New Model GCX enable you to shave the larger, heavier gears (up to 24" Pitch dia.) with the same facility and precision as smaller gears are shaved.

Methods of loading and unloading are unrestricted. The work is loaded with the table at the extreme limit of its travel—clear of any overhead interference.

At the end of the shaving cycle, the cutter head rises in rapid traverse to clear the work and the table returns to its loading station for quick unloading.

If you manufacture such gears as are used in trucks, agricultural or ordnance equipment, ask for Bulletin S60-8 and get the full details of this new, economical method of gear shaving.

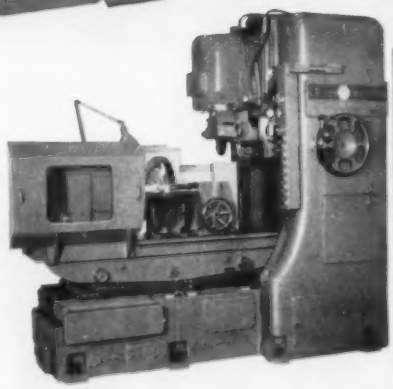


Table in loading position

EXCLUSIVE RED RING ADVANTAGES

- Cutter above the work permits chips to fall away from and not into the cutter teeth.
- Thus positioned, the cutter is not vulnerable when the work is accidentally dropped while being loaded.
- Cutting pressure is applied downward, taking full advantage of gravity for rigid stability.
- Floor space, less — Rigidity, greater

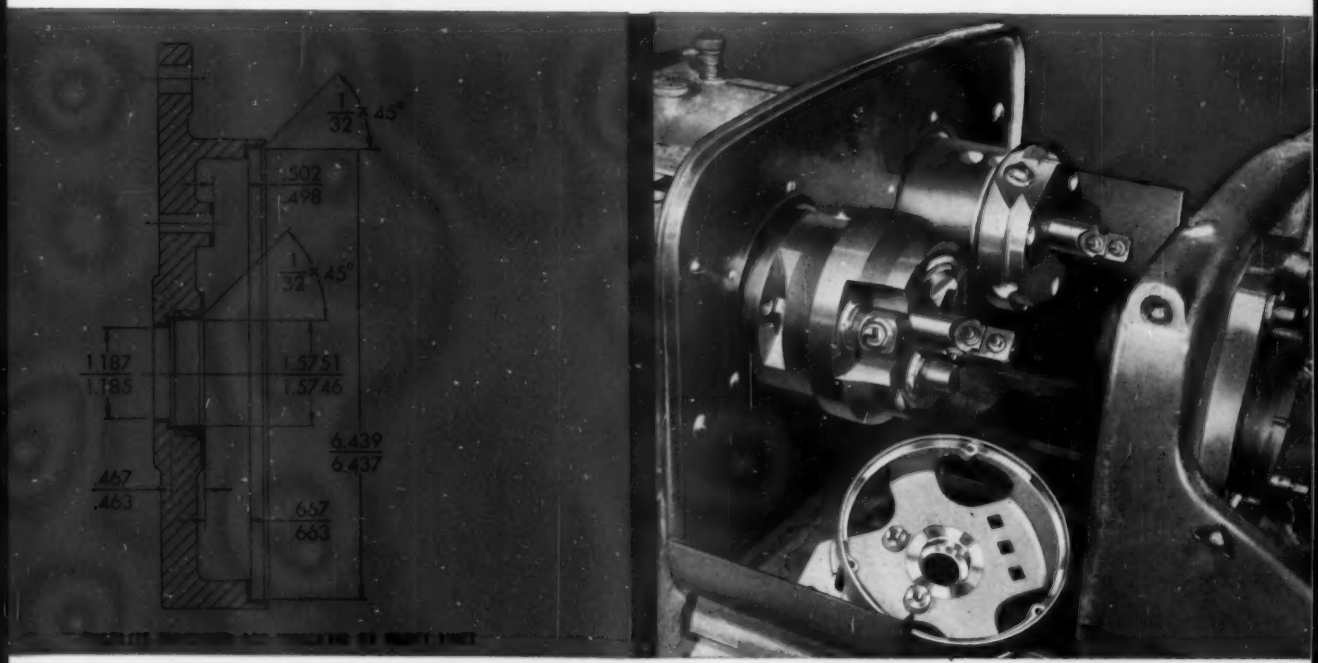
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NATIONAL BROACH & MACHINE CO.

5600 ST. JEAN • DETROIT 13, MICHIGAN

WORLD'S LARGEST PRODUCER OF GEAR SHAVING AND HONING EQUIPMENT

9 surfaces rough and finish machined in 2 passes...



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Special Microbore Cluster Tooling makes it possible for a leading electrical equipment manufacturer to obtain a continuous flow of finished parts by rough and finish machining, simultaneously, nine surfaces on a generator end bell casting in two passes.

SET-UP TIME IS FASTER, TOO—Independent, precision adjustment of each tool point permits accurate settings in a matter of seconds. Speed and accuracy of adjustment, plus compactness of Microbore units, makes cluster tooling practical to a degree formerly considered impossible.

Microbore is a versatile tool with unlimited application for all types of boring, turning and facing operations. Microbore Standard Boring Bars, Boring Bar Sets and Flash-Change tooling complete the perfect combination for accurate, quick change tooling.



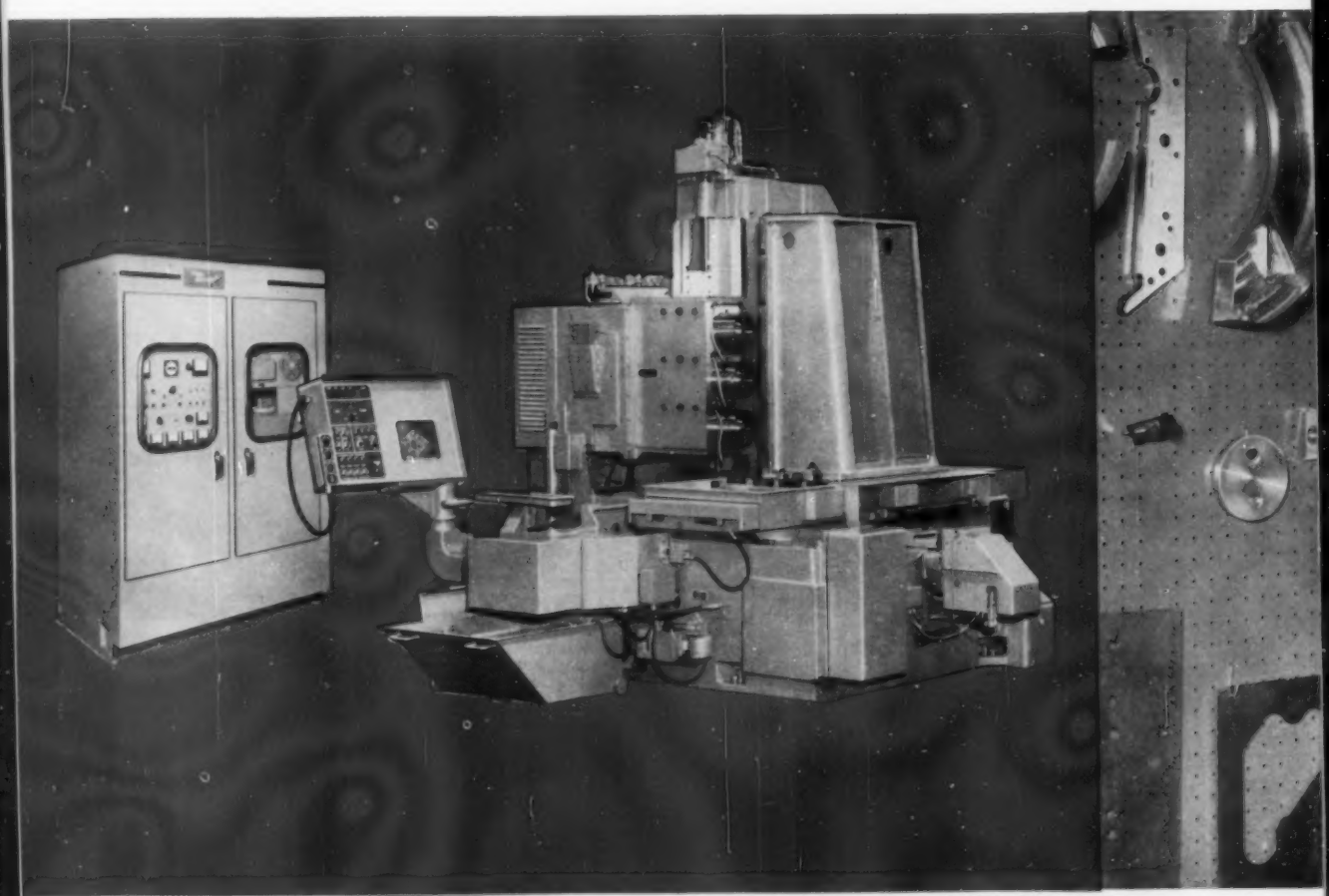
• To find out how Microbore can help you, write for our new catalog No. 58.

DeVlieg Microbore System

DE VLIEG MICROBORE • DIVISION OF DE VLIEG MACHINE COMPANY

Fair Street • Royal Oak, Michigan

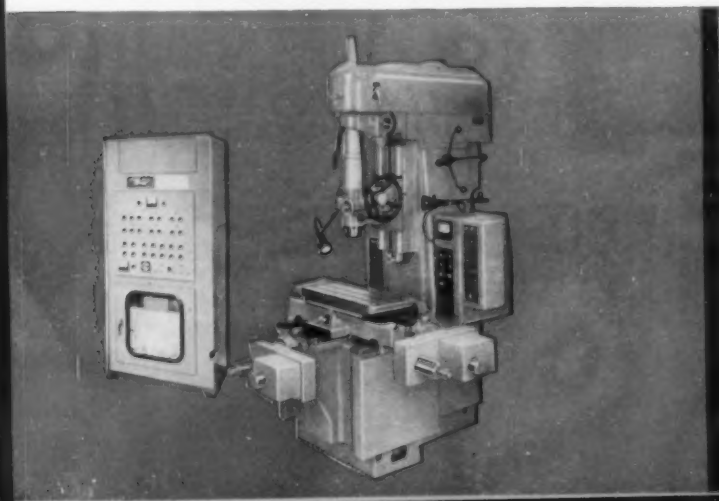
NOW—BENDIX OFFERS COMPLETE LINE



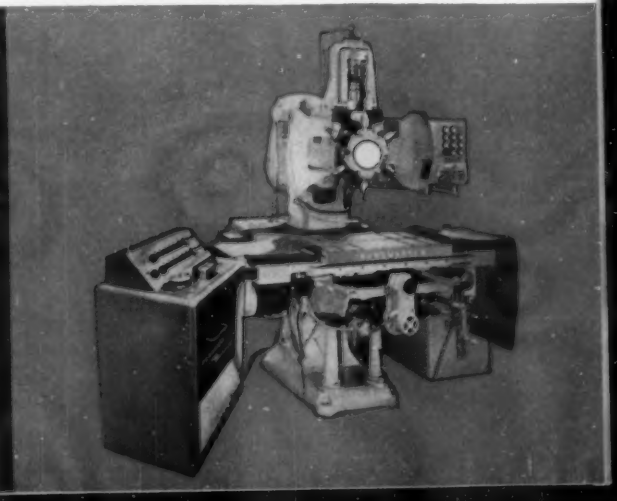
DYNAPATH-23 NUMERICAL CONTOURING CONTROL. Featuring *Circular Interpolation* to permit the close-tolerance machining of arcs and circles, as well as straight lines, with a minimum of input data. Offers 0.0002-inch resolution on 2, 3, or more axes of control. Each application individually engineered for the best possible combination of machine tool and control unit.

TREMENDOUS VARIETY of parts machined with Bendix numerical control shown here. Parts range from complex missile components to simple but extremely accurate cams.

DYNAPOINT-22 NUMERICAL POSITIONING CONTROL. Provides the finest electronic resolution available anywhere—0.000010" for jig borer accuracies within 0.0001" on finished parts. Uses 8-channel binary-coded decimal tape format—compatible with other N. C. units and with standard tape preparation equipment.



FERRANTI FP-22 NUMERICAL POSITIONING CONTROL SYSTEM. Floating zero for fast, easy set-up and low-cost tooling. Dial input provides manual operation flexibility. Wear and loss of accuracy eliminated because there are no contacting parts in measuring units.



OF NUMERICAL CONTROLS



New, completely transistorized POSITIONING and CONTOURING units provide greater reliability, lower operating costs and made-to-order accuracy.

Tested and proven in scores of installations, over thousands of productive hours, Bendix numerically controlled contouring systems have become recognized as the finest. Based on this solid history of achievement, The Bendix Corporation now introduces its second generation control systems, the DynaPath-20 Series Numerical Contouring Controls, and the Dyna-Point-20 Series Numerical Positioning Controls.

To further extend its broad coverage of the numerical control field, Bendix has obtained exclusive rights to distribute the Ferranti tape controlled positioning units and Ferranti's unique coordinate measuring machine.

Bendix backs up the most complete line of numerical control equipment with the best and most complete service organization in this country. From application engineering through tape preparation, customer training and field service, Bendix has had more teamwork experience than has any other electronic controls manufacturer in the field.

Only at Bendix can the machine tool builder and user find everything he needs for numerically controlled manufacturing. Why not investigate Bendix PACKAGED PRODUCTIVITY today.

FERRANTI FI-22 COORDINATE MEASURING MACHINE. Checks workpieces up to ten times faster than conventional methods. Direct and continuous readout (in ¾-inch figures) of hole center locations with one-set-up simplicity. Accuracy of ±0.001″ over entire 15″ x 24″ range.



THE Bendix CORPORATION

See the new Ferranti Measuring Machine.
Get latest information on
Bendix Numerical Control Equipment
at
WESTERN ASTME SHOW

Booth 435 • Sports Arena, Los Angeles • Nov. 22-26

How George Deickert upped grinding

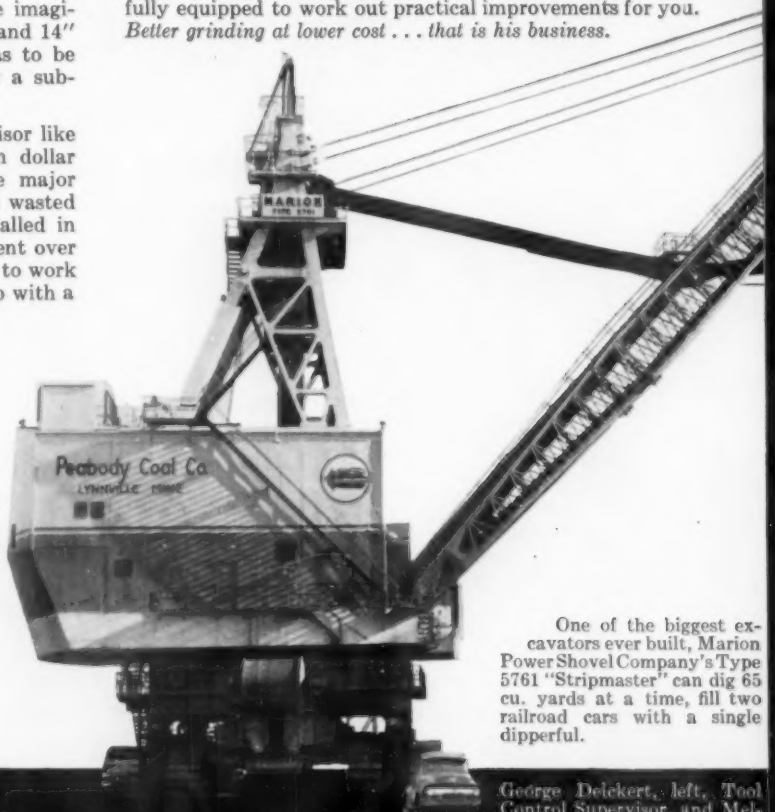
Watchmakers have nothing on the builders of Marion power shovels as far as accuracy is concerned. Some of the shafts on Marion's biggest shovel (two full carloads in a single scoop!) have to be finished to a tolerance of ±.0004" on bearing surfaces.

The sheer size of these grinding jobs staggers the imagination too. The steel shafts run up to 12 ft. long and 14" in diameter so a tremendous amount of metal has to be removed and the grinding operation accounts for a substantial chunk of costs.

That's where an outstanding Tool Control Supervisor like Marion's George Deickert is worth his weight in dollar bills. His analysis of the situation showed five major deficiencies in the wheels used for the job and he wasted no time turning dissatisfaction into action. He called in Bay State Abrasive Specialist Dick Crofoot and went over the whole problem with him in detail. Crofoot went to work with the engineering staff at Westboro and came up with a specification that did both grinding and finishing *and* ensured: (1) 30% faster stock removal. (2) Excellent instead of poor size control . . . *easily within* the ± .0004" tolerance. (3) Consistent finish at 20 RMS. (4) 50% less dressing. (5) Greatly improved wheel life. (6) Consistent duplication of performance, wheel after wheel.

As George Deickert himself says: "This isn't the only job that Bay State has done well on for us. We have dozens of different types of grinding jobs . . . and we use a great many different types of wheels, including tool wheels. Bay State not only does a lot of jobs for us and does them well . . . they have also been able to duplicate excellent first performances with their follow-up wheels."

If your grinding operations . . . large, small or micro-miniature . . . are less than 100% efficient by current standards of abrasive technology, your Bay State distributor or direct representative is thoroughly trained and fully equipped to work out practical improvements for you. *Better grinding at lower cost . . . that is his business.*



One of the biggest excavators ever built, Marion Power Shovel Company's Type 5761 "Stripmaster" can dig 65 cu. yards at a time, fill two railroad cars with a single dipperful.



George Deickert, left, Tool Control Supervisor, and Melvin A. Griffith, grinding machine operator — Marion Power Shovel Co., Marion, Ohio — check progress of large, high carbon molybdenum steel shaft being ground by a Bay State cylindrical grinding wheel.

speed 30% and cut dressings by 50% at MARION POWER SHOVEL

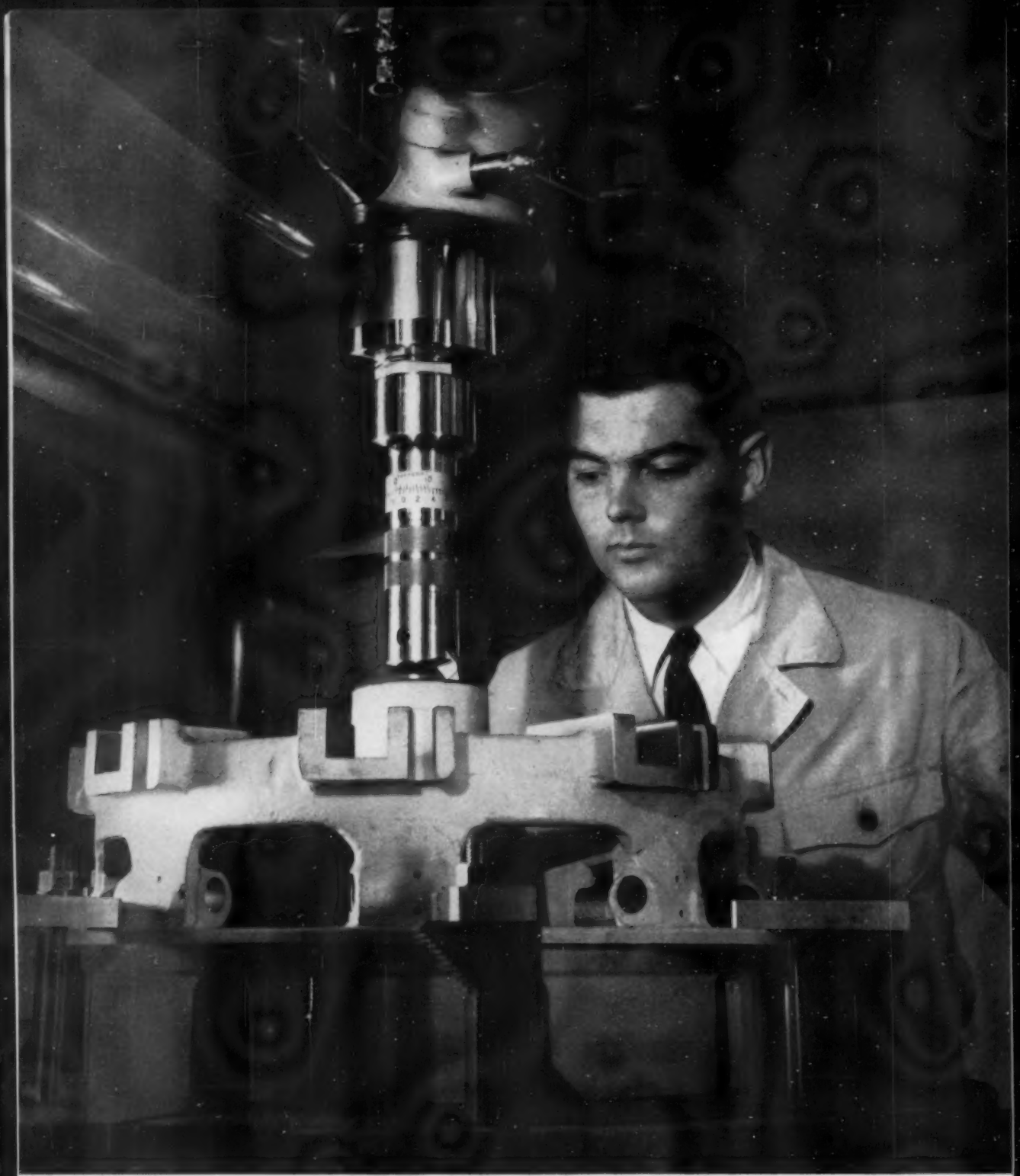


George Deickert's background is impressive to put it mildly. His technical training started in Germany with a Masters Degree in steam and combustion engineering from Berlin University. His business career includes hitches with United Carbon Co., and Weston Instrument Co., in Newark, N. J. and fifteen years with Curtiss-Wright in Patterson, N. J. Starting as a Methods Engineer, he's been with Marion Power Shovel since 1947. He has used Bay State wheels since 1932 and says they have never let him down.

BAY STATE ABRASIVES

BAY STATE WHEELS of PROGRESS

Bay State Abrasive Products Co., Westboro, Massachusetts.
In Canada: Bay State Abrasive Products Co., (Canada) Ltd., Brantford, Ontario.
Branch Offices: Chicago, Cleveland, Detroit, Los Angeles, Pittsburgh. *Distributors:* All principal cities.



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Precision and reliable performance are two important reasons why SIP Hydroptic Machines are first choice of leading manufacturers in the metalworking industry.

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TOOL NEWS

★ ***Since 1957, applied in 20,000 special boring, facing, turning, milling and chamfering tools***

★ ***Simplifies combining of operations***

WESSON Standardized Cartridge System Revolutionizes Special Tool Field

This little cartridge is the simple answer to thousands of special tool needs.

In only 3 years, the Wesson adjustable cartridge tooling system has revolutionized the design of thousands of multiple point tools for boring, milling, chamfering, turning and facing. (For examples, turn the page.)

The standard 5 styles shown below, alone, cover the vast majority of all special multi-point tool requirements resulting in minimum inventory cost, minimum tool design and fabricating cost. From 2 to 18 or more operations may be combined in a single tool with the Wesson cartridges. Adjustable in two directions, the cartridges with their throw-away inserts cut down-time for setup and tool changes. They come in 5 styles (for square, triangular or pentagonal inserts) and in left and right hand types.

The same cartridge can be used for machining different materials simply by switching to the required Wessonmetal grade. When a tool is no longer needed, cartridges can be switched to other uses. Damaged cartridges can be quickly replaced from stock, avoid high special tool replacement cost.

You can often use special tools for different size parts by simply adjusting the cartridges. Designed to provide maximum chip clearance and to protect the cutter body, cartridges are rigidly retained in the body.

Get our latest bulletin (C-660) on these standardized cartridges by circling A-2 on the Readers' Service Card. Circle A-1 and our representative in your area will show you numerous illustrations of some of the 20,000 different special tools in which these cartridges have proven themselves.

Please turn the page . . .



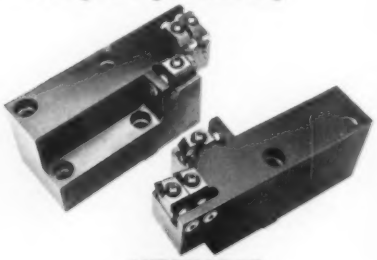
These 5 cartridges will take care of almost all special tools.

Some of the many specials using WESSON cartridges



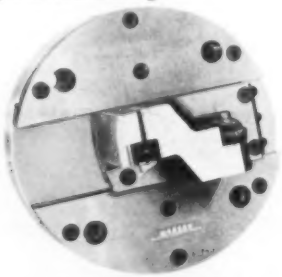
AUTO TRANSMISSION CASE

15 different operations with one tool —boring, facing, chamfering.



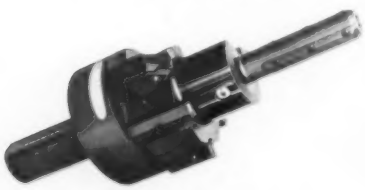
AUTOMOTIVE

Simple tool block for multiple turning and chamfering.



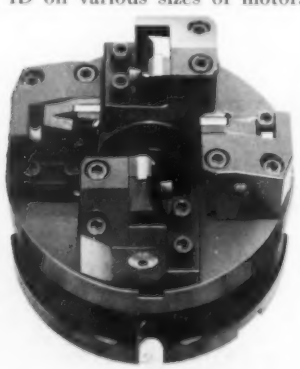
HYDRAULIC VALVES

Interchangeable preset blocks and cartridges face ends of all valve sizes.



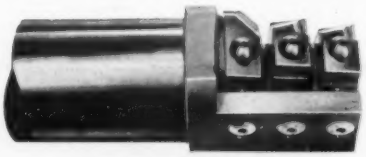
ELECTRIC MOTORS

Bores and faces all bearings, chamfers OD, ID on various sizes of motors.



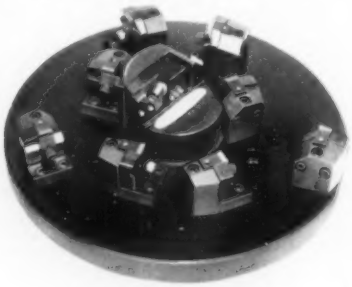
STEERING ASSEMBLIES

Hollow mill turns ends of control arm shafts.



AIRCRAFT ENGINES

Simple boring bars perform multiple boring and chamfering.



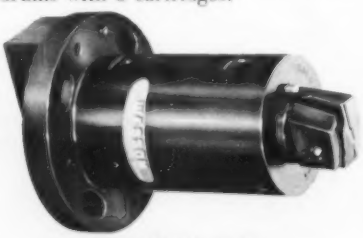
CLUTCH HOUSING

Bores and faces clutch housing of cast aluminum. Facing units have special cartridges.



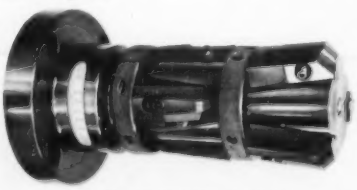
BRAKE DRUMS

This boring tool R & F bores brake drums with 8 cartridges.



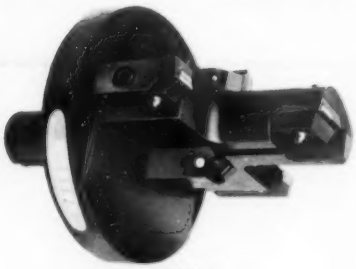
ALUMINUM SLABS

Milling cutter units to closely control face run-out in slab milling of aluminum ingots.



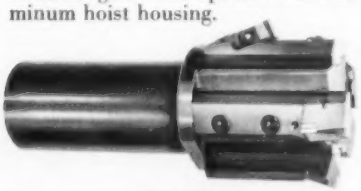
CONNECTING RODS

Rough and finish bores big ends of rods, Three cartridges per diameter simultaneously adjustable.



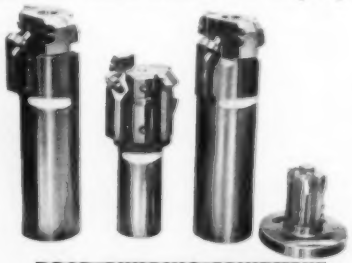
HOISTS

Semi-finish bores, chamfers end and faces flange in one operation on aluminum hoist housing.



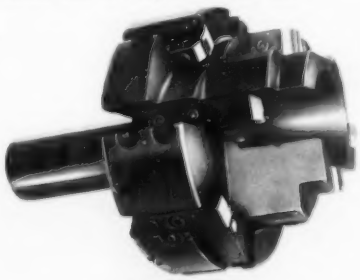
TRACTORS

Rough bores, grooves, chamfers both ends and finish bores collar coupling.



ROAD BUILDING EQUIPMENT

R & F connecting rods to a diameter tolerance of only ±0.0002 in.



CONVERTER

Bores, counterbores, turns ID of hub, triple-faces and double-chamfers converter housing.

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TO ASSURE YOUR PRODUCT'S EFFICIENCY

Whenever you have a gear problem—any gear problem—consult Illinois Tool Works for the right answer!

From transmissions to turbines—from radar antennas to atomic reactors—if your product requires gears or gear trains, Illinois Tool Works has the experience, skill and facilities to solve your gearing problems.

Gear users and gear producers are now offered valuable assistance in gear analysis, gear design, prototype and model manufacture, gear tooling and quality control. This complete program is available to help you improve product efficiency and economy to strengthen your competitive edge.

As a proven advisor to the Army, Navy and scores of power-product manufacturers, Illinois Tool has gained the background and engineering know-how to accurately analyze your gearing problem and to recommend the most satisfactory solution for your specific requirements. This service even includes training your personnel.



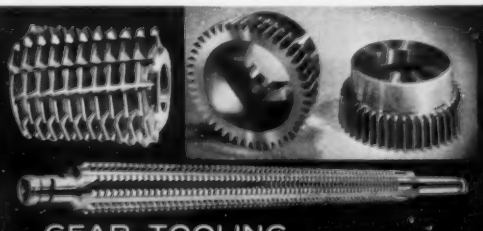
Write Today for your "Gear Technical File"



GEAR QUALITY CONTROL

Gear specialists at Illinois Tool have developed gear measuring instruments, ranging from simple hand rolling fixtures to fully automated final gear inspection machines. Among these are units capable of mechanically inspecting hundreds of gears per hour for all known elements and sorting them categorically. Whatever your quality control requirements let Illinois Tool recommend the system best suited to your needs.





GEAR TOOLING

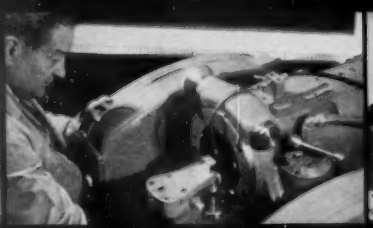
Illinois Tool Works hobs, shaper cutters, broaches and gear cutters are used to produce thousands of gears daily. They are specified by nearly every major gear producer in the country—proof of their quality, efficiency and economy.



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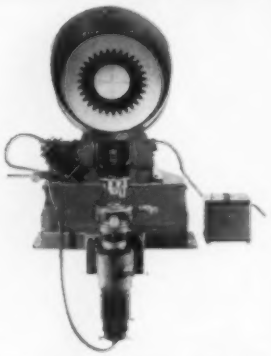
Illinois Tool Works maintains (a) a complete atmosphere-controlled laboratory fully equipped for analyzing and inspecting gears, gear trains or gear-like parts; (b) an engineering staff to design and/or recommend gear drives; (c) development facilities to produce models and prototypes; (d) a process group to detail production and quality control procedures; (e) employee training for your personnel which includes a highly concentrated classroom-and-shop course in gear engineering, production and quality control.

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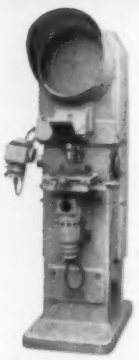
In Canada: CITCO DIVISION, CANADA ILLINOIS TOOLS, Ltd., Don Mills, Ontario

NIKON

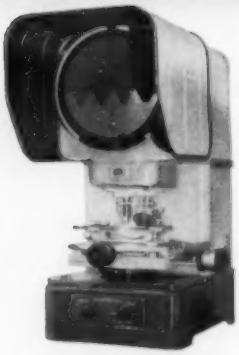
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OPTICAL COMPARATOR—BENCH MODEL 2



OPTICAL COMPARATOR—FLOOR MODEL 3



OPTICAL COMPARATOR—BENCH MODEL 6



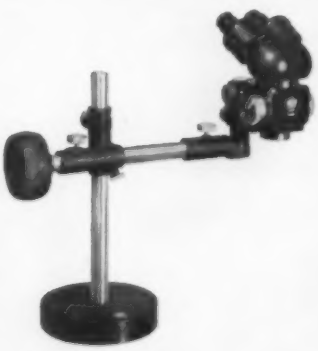
AUTO-COLLIMATOR—MODEL 1



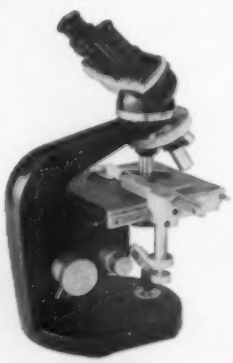
AUTO-COLLIMATOR—MODEL 3



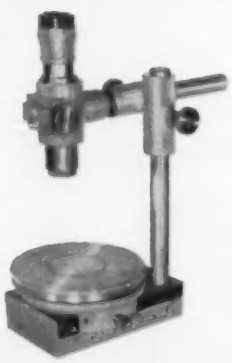
STEREO MICROSCOPE—MODEL SM2



STEREO MICROSCOPE—MODEL SM



BINOCULAR MICROSCOPE—MODEL SBR

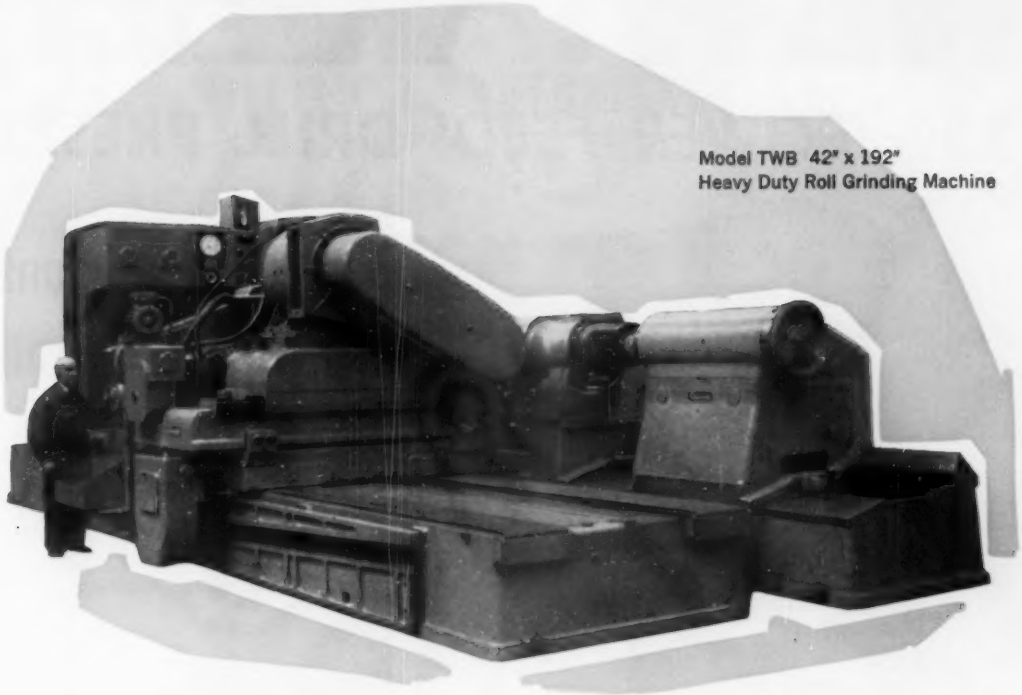


SIMPLE MEASURING MICROSCOPE

The above is only a partial listing of the many Nikon instruments designed to meet measurement and inspection requirements in production, quality control, intricate parts assembly, and other applications demanding fast, accurate inspection. For complete details, write to Dept. TE-11

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Model TWB 42" x 192"
Heavy Duty Roll Grinding Machine

LAPOINTE CHURCHILL

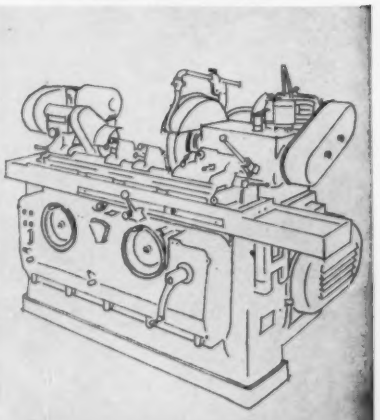
Precision Grinding Machines
Available up to 72" x 432"

A full range of PRECISION GRINDING MACHINES is now offered, in sizes all the way from toolroom type up to the very largest heavy duty roll grinding machines *36 feet between centers,* with the patented automatic electronic feed mechanism.

All are engineered for simplicity of operation, and ruggedly built with utmost care to perform the most exacting grinding operations. It can honestly be stated that no finer quality can be obtained than is built into these Lapointe Churchill Grinding Machines.

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Model AW, 6" x 18"
Plain Cylindrical Grinding Machine



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LAPOINTE
PRECISION MACHINE TOOLS

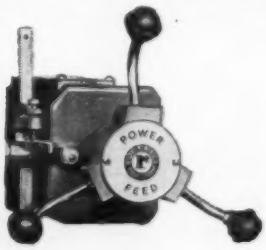
NEW: W-T WALKER-TURNER

20" 'POWER FEED' DRILL PRESSES



combine up-front control with one-hand operation

Every model in this new W-T "Light-Heavyweight" line (and there are 16 of them to fit your needs) offers a revolutionary new mechanical power feed with performance features NEVER BEFORE AVAILABLE on a standard drill press. Now you can do continuous, heavy duty production drilling faster, easier and with greater accuracy.



For unequalled flexibility—front mounted pilot wheel is mechanically integrated with clutch control to provide easy one-hand engagement of power feed; drill point pressure is infinitely adjustable from 0 to maximum capacity of machine; furnishes power and thrust for drilling 1" diameter holes, yet adjusts for use with 1/16" bits.

For unmatched versatility—built-in control permits remote operation and can be electrically, hydraulically or mechanically interlocked with other units or synchronized with automation devices. Operator can utilize four feed ratios, drill manually, mechanically or in combination.

See your Walker-Turner Distributor (under "TOOLS" or "MACHINE TOOLS" in the Yellow Pages) for a demonstration. The only way to really appreciate the many outstanding features of these new W-T 20" 'Power Feed' Drill Presses is to see them *in action*. For FREE brochure giving specifications and information on how to adapt your present W-T 20" drill presses to 'Power Feed', write: Rockwell Manufacturing Company, Walker-Turner Division, Dept. WL-26, 400 N. Lexington Ave., Pittsburgh 8, Pa. In Canada: Rockwell Manufacturing Company of Canada, Ltd., Guelph, Ontario.

WALKER-TURNER
"LIGHT-HEAVYWEIGHT" MACHINE TOOLS
another fine product by
ROCKWELL

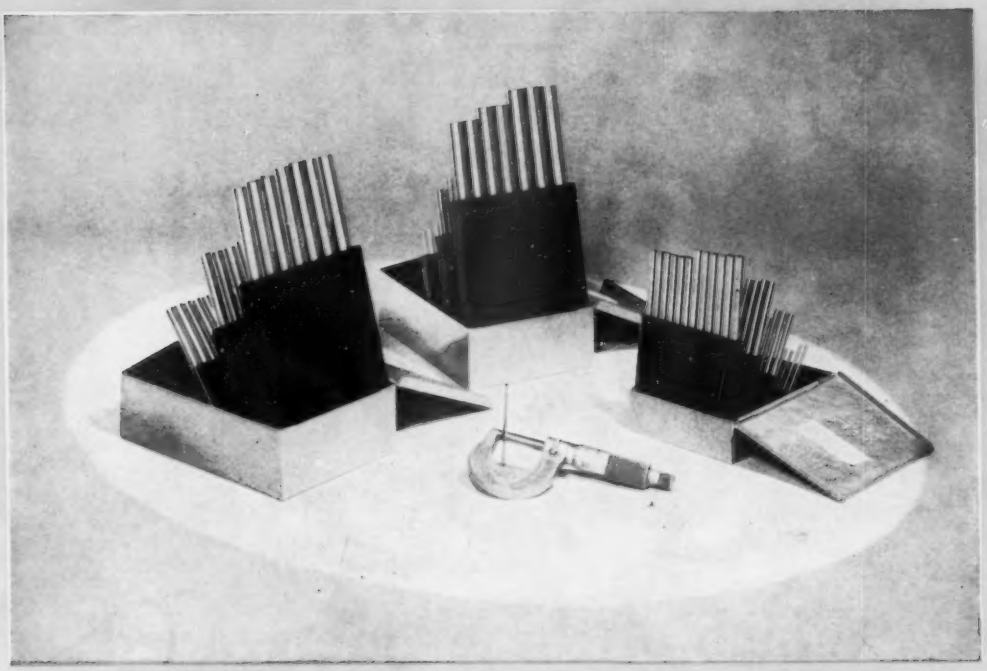
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DRexel 6-4222 ESTABLISHED 1927

WILLIAM T. HUTCHINSON CO.

53 BROWN AVENUE SPRINGFIELD, NEW JERSEY

HUTCHINSON HSS BLANKS



115 Pieces – COMPLETE – .040" to .500" – $88.00

your choice of two tolerances

+ .0002" − .0000

or

+ .0000 − .0002"

JOBBER SET	LETTER SET	WIRE SET
$32.27	$29.03	$27.40
in Huot Index	in Huot Index	in Huot Index

HIGH SPEED STEEL — 64 "C" scale hard — gage tolerance — mirror finish — parallel ground.

ANY DECIMAL DIAMETER OF STANDARD LENGTH
.010" TO 1.000" SHIPPED ON 24 HOUR NOTICE



Which of these "job-graded" Carboloy® cemented carbides is right for your operation? And why?

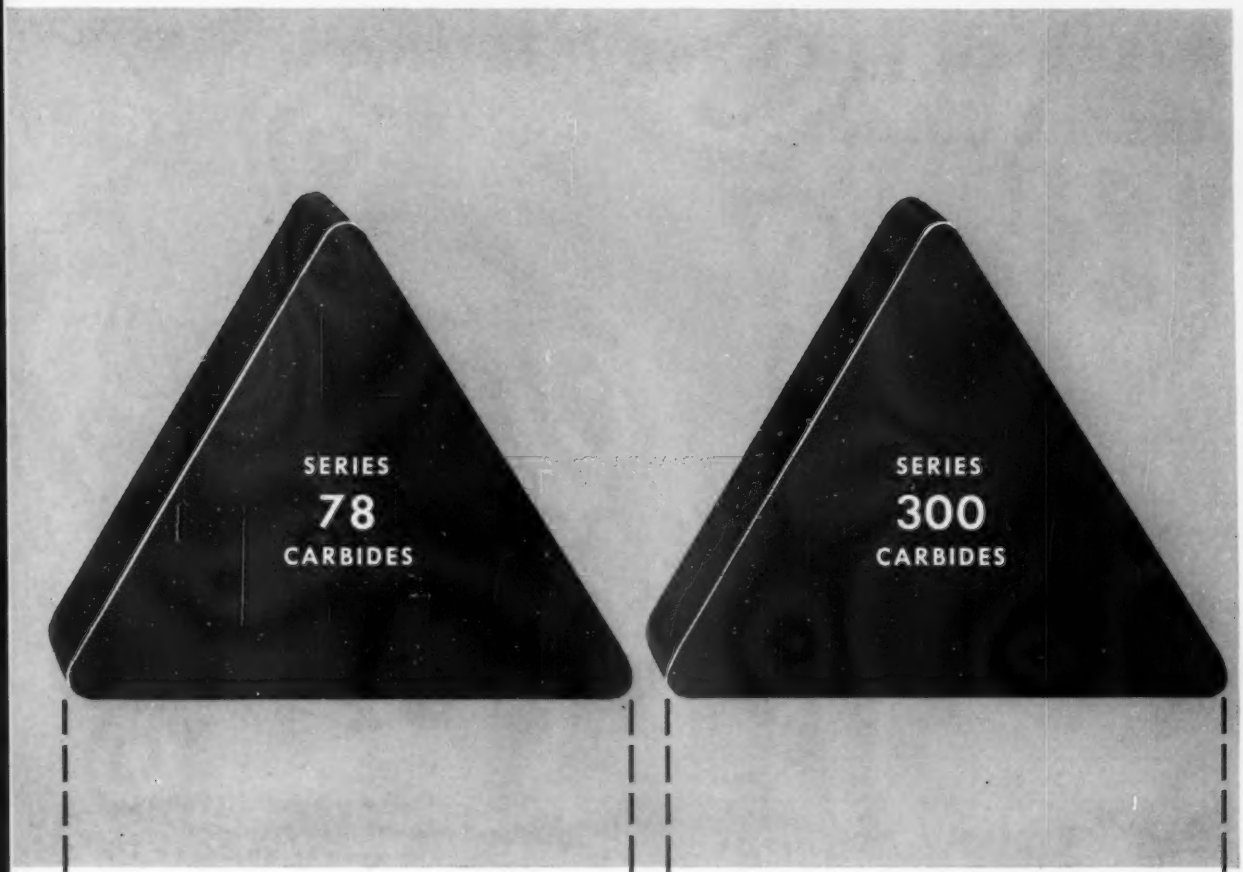
What is your machining problem? Carboloy cemented carbides are job-graded for *every* disposable insert and carbide-cutting-tool application as a solution to your problem. Job-graded to help you choose the *right* carbide. Job-graded so you can count on optimum results from every Carboloy tool or insert you use. *And, with Carboloy carbides, you get the same consistent quality order after order after order!*

Carboloy inserts for steel-cutting grades are available PRE-HONED!

Ready-to-use inserts honed to a precise radius in a complete line of job-graded carbides – that's what you get when you specify pre-honed Carboloy cemented carbide inserts.* Designed to reduce chipping, increase predictable tool life, withstand cutting pressures better, Carboloy pre-honed inserts offer savings in time and labor.

Your Carboloy representative or Authorized Distributor is the man who can best fill you in on the job-graded carbide best suited to *your* machining requirements. Contact him today . . . or write: *Metallurgical Products Department of General Electric Company, 11101 E. 8 Mile Road, Detroit 32, Michigan.*

*Carbides in the 78 series are all pre-honed. Carbides in the 300 series are available pre-honed, precision-ground, or utility ground.



78 SERIES GRADES

Where machine capacity is limited, the low initial tool cost of 78 series carbides provides real economy in normal steel-cutting operations; offers optimum output-per-dollar. In this series, the improved 78B grade is best to use where carbides are being initially applied to steel-machining operations. *All* disposable carbide inserts in the 78 series come pre-honed to serve you better; save you time and labor.

300 SERIES GRADES

Heavy-duty, heavy-feed steel-cutting applications? Then a carbide from the 300 series is the one to choose. This is the Carboloy series designed to cover a wide range of steel-cutting operations – everything from precision finishing to heavy-duty roughing – *all* at a lower cost-per-piece for such a variety of jobs. Most inserts in the 300 series are available *pre-honed*, precision-ground, or utility ground.

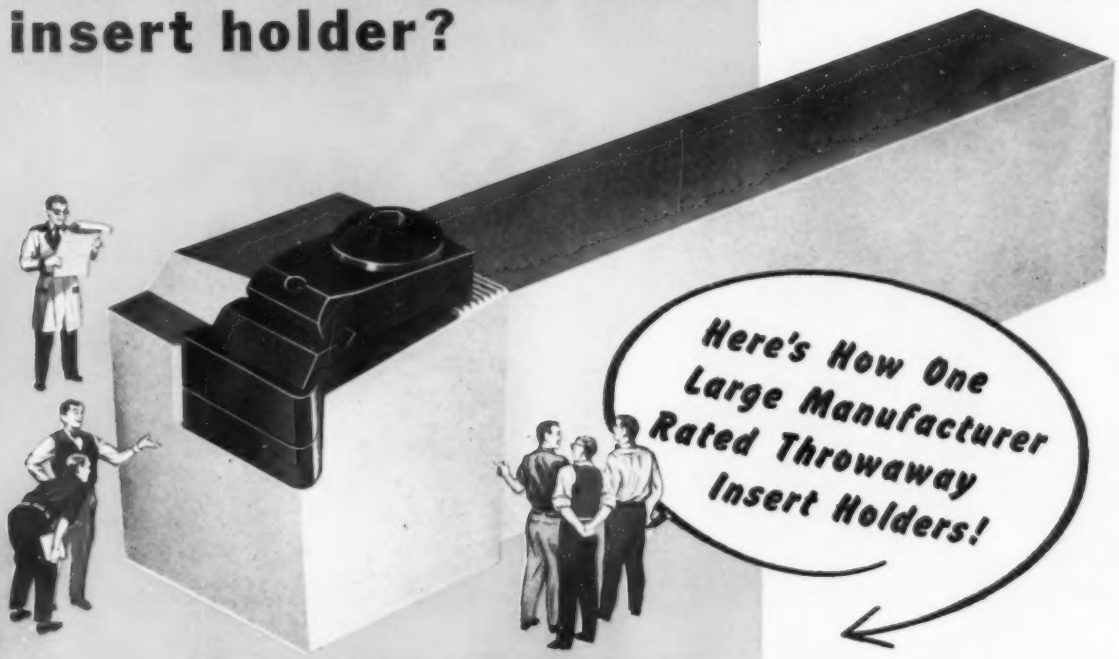
CARBOLOY®
CEMENTED CARBIDES

METALLURGICAL PRODUCTS DEPARTMENT

GENERAL ELECTRIC

CARBOLOY® CEMENTED CARBIDES • MAN-MADE DIAMONDS • MAGNETIC MATERIALS • THERMISTORS • THYRITE® • VACUUM-MELTED ALLOYS

What do you want in a throwaway insert holder?



SPECIFICATION	MAKE OF TOOL																		
	VALENITE	A	B	C	D	E	F #1	F #2	F #3	G	H	I	J	K #1	K #2	K #3	L
Inserts of standard indexable design	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Adjustable chipbreaker	●	●								●	●	●	●	●	●		●
Surface to surface contact between chipbreaker and insert	●			●	●	●	●						●	●		●	●	
Replaceable chipbreaker—independent of clamp	●			●	●	●	●			●	●	●	●		●	●	
Removable locking pin prevents chipbreaker loss when indexing insert	●	●	●					●	●	●	●			●			●
Clamp arrangement does not obstruct chip flow	●	●	●	●	●		●		●	●	●	●	●	●			●
Clamp arrangement does not place an eccentric load on clamp screw	●	●		●	●	●		●	●				●	●	●	●	●
Replaceable and indexable shim seat—stocked for variable insert thicknesses	●	●	●	●	●	●				●	●	●					
Holders available in all styles for positive and negative rake, and square and triangular inserts	●		●		●	●						●					

Only the Valenite Throwaway Insert Holder* met all nine important specifications.

The Valenite Holder is THE standard in more large plants! It gives faster, more trouble-free production—a better product at less cost.



The new 32-page Valenite Turning Tool Manual lists over 200 styles and sizes of throwaway insert holders . . . gives job application data . . . has tracing templates for your engineering department. It's free. Ask for it on your company letterhead, or call your Valenite representative.

VALENITE® METALS

BOX 205 A
ROYAL OAK, MICHIGAN

* Patented



. . . Why Thin Webs

ON HEAVY DUTY DRILLS?

STANDARD'S Technicians corrected the thinning difficulties, previously experienced when using the conventional type heavy duty drill.

. . . the web thinning process is "built-in" the flute contours . . . a design feature that gives . . .



STANDARD'S *"self-thinned"* HEAVY DUTY DRILL*. . .

1. UTMOST ACCURACY . . . no flute or point distortion due to free hand resharpening.



2. CONSISTENT TOOL PERFORMANCE FROM GRIND TO GRIND.

3. MORE SHEAR . . . outer cutting edge more advanced of center.

4. IMPROVED CHIP CONTROL . . shape of cutting edge acts as chip breaker.

*U. S. Patent No. 2,778,252.



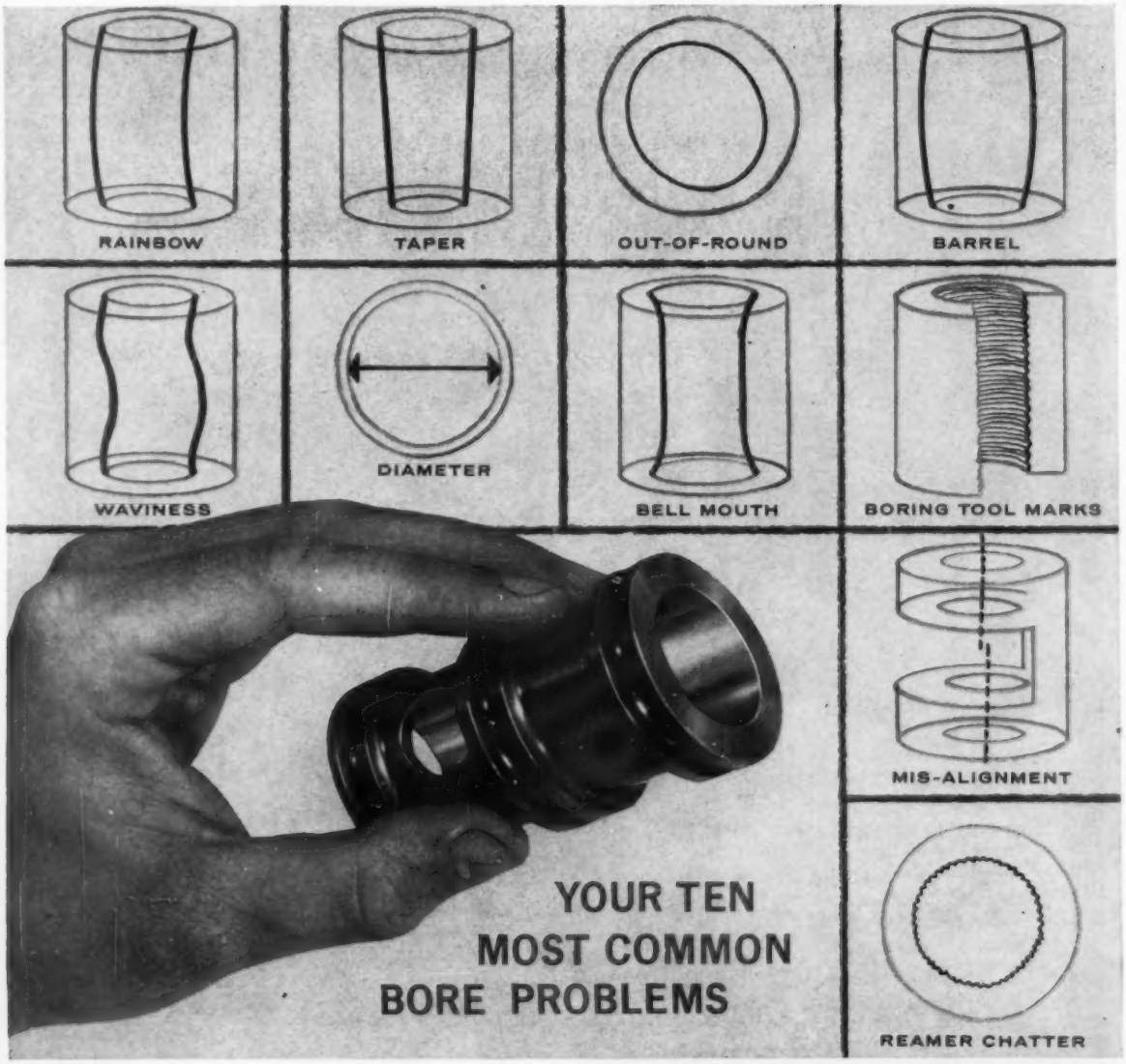
STANDARD'S
Authorized Distributors
Stock-ready for immediate delivery—the COMPLETE FAMILY OF STANDARD QUALITY CUTTING TOOLS,
Twist Drills . . . Reamers . . . Taps . . . Dies . . . Milling Cutters . . . End Mills . . . Counterbores . . . Hobs . . . Carbide Tools and Gages.

If you have a real tough machining assignment, especially on hardness above ROCKWELL C-30 (285BHN) . . . or on Alloy Steel, Stainless Steel, Hard Cast Iron, High Temperature Alloys . . . Call your STANDARD Distributor, he has a Practical and ECONOMICAL solution.

STANDARD TOOL CO.

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BRANCH WAREHOUSES IN: NEW YORK · DETROIT · CHICAGO · DALLAS · LOS ANGELES · SAN FRANCISCO



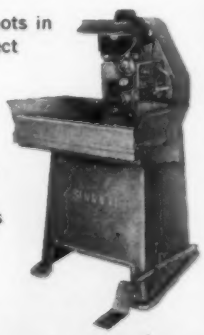
All these bore errors from previous operations can be corrected fast and with minimum stock removal by Sunnen Honing.

This fast abrasive stock removal process is often used to take out substantial amounts of stock as well as for final sizing.

Stock is removed first from all high spots in the hole, immediately generating perfect roundness and straightness without changing original hole alignment. Tolerance is guaranteed to .0001", with any desired surface finish.

When you specify Sunnen Honing for your I.D. operations, you eliminate delayed schedules and bottlenecks as well as scrap and salvage costs caused by hole problems.

Average installation including tooling runs about $1,000.



CORRECT ALL OF THEM WITH

SUNNEN HONING

SUNNEN PRODUCTS COMPANY 9281

7927 Manchester Ave. • St. Louis 17, Mo. • Canadian Factory: Chatham, Ontario

ASK FOR FREE BOOKLET

. . . with 99 case histories showing production rates and other data on all types of bore-sizing problems.



TODAY'S TOLERANCES AND FINISHES CALL FOR HONING

IT'S A FACT!

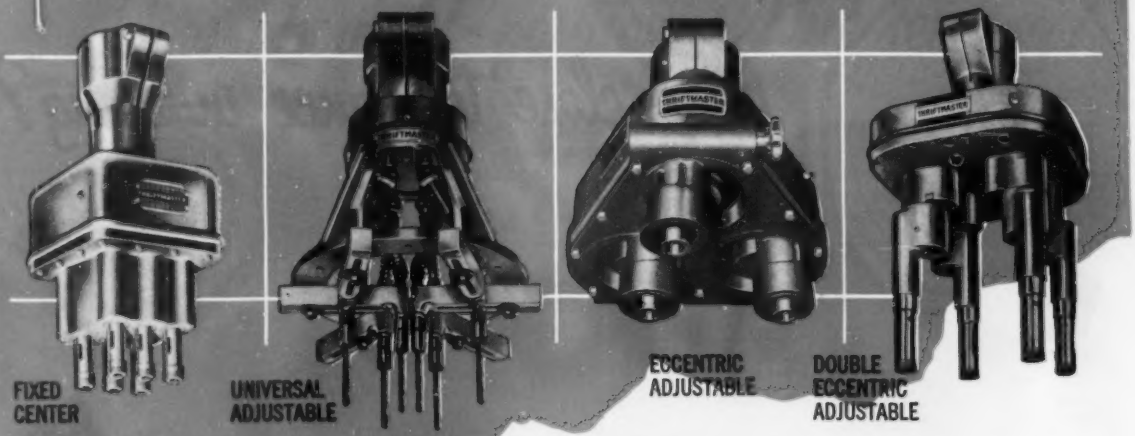
DRILLHEADS
ARE OBVIOUS.

Tremendous economies from the use of multiple-spindle drillheads are obvious. Drilling one hole at a time cannot be tolerated in this day of automation!

THOMSON
THRIFTMASTER
Drillheads
are your best Drillhead buy...

1. They are better built and cost no more (Full ball bearing construction, hardened gears, spindles and driver, and precision grinding!)
2. This means they last longer
3. This eliminates down time
4. This eliminates production losses
5. This drastically reduces drilling costs

THOMSON
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Drillheads are designed and produced by engineers whose experience **in this specific field** dates back to 1923. This long accumulation of engineering technique and production "know-how" is reflected in our product—**a quality tool... solid, substantial and dependable!**



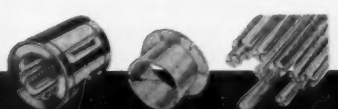
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REAM • BORE
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Subsidiary of
THOMSON INDUSTRIES, INC.
makers of BALL BUSHINGS • NYLINERS • 60 Case Shafting

EVERY SECOND A TOOL STANDS IDLE WHILE AN OPERATOR LOADS OR UNLOADS COSTS YOU MONEY

Any one of these BELLOWS-VALVAIR Air-powered Work Feeders can cut that idle time in half!

Need close tolerance indexing?



Model BRET-13B
13" diameter top
Factory set for either 4, 6, 9, 12 or 18 stations

Model BRET-26C
26" diameter top
Factory set for either 4, 6, 9, 12 or 18 stations (may be ordered for a maximum of 36 stations)

Extremely close indexing tolerances . . . that is the extra feature built into this group of Bellows-Valvair Rotary Index Tables. Built to rigid standards of workmanship and material, they provide a quality of performance unmatched in their field. These units, too, have built-in controls to regulate the indexing speed; they are complete units, just make the necessary electrical and air supply connections; they may be easily synchronized with other Bellows-Valvair equipment to build completely automatic, high speed special purpose machines.

Need high speed work positioning?

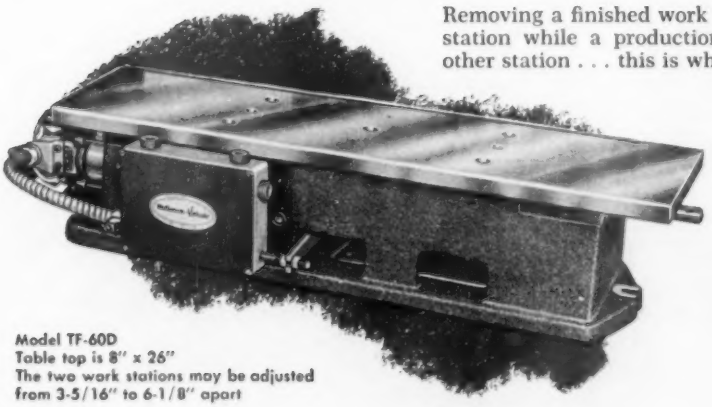


Model BRET-10C
10" diameter top
Adjustable for 4, 6, 8, 12 or 24 stations

Model BRET-22C
22" diameter top
Factory set for either 4, 6, 9, 12, 18 or 36 stations (may be ordered for a maximum of 72 stations)

These Rotary Feed Tables position work pieces with high accuracy, at a rate to match machine efficiency. The units are complete; require only mounting, attaching electrical connections, coupling with air supply. They may be mounted in any position thereby allowing a wide range of application for feeding a variety of work pieces in very simple or complex machine or processing systems. Indexing speed is easily controlled . . . two speed control screws on the Electroaire Valve® may be adjusted to regulate the rotating speed of the table top. Oversize table tops may be attached to the standard top.

How about 2-position shuttle feeding?



Model TF-60D
Table top is 8" x 26"
The two work stations may be adjusted from 3-5/16" to 6-1/8" apart

Removing a finished work piece and positioning a raw part at one station while a production operation is being performed at the other station . . . this is what the Bellows-Valvair Shuttle Feed provides and, by doing so, unloading and loading time does not interrupt the machining operation. Speed of movement of the top is easily adjusted by the control screws built into the Electroaire Valve controlling the Bellows Air Motor®. The unit is complete when received, ready to install and operate. And, it may be synchronized with other Bellows-Valvair equipment . . . a feature of all Bellows-Valvair "Controlled-Air-Power" Packaged Units.

872C

Bellows-Valvair
AKRON 9, OHIO
DIVISION OF INTERNATIONAL BASIC ECONOMY CORPORATION (IBEC)

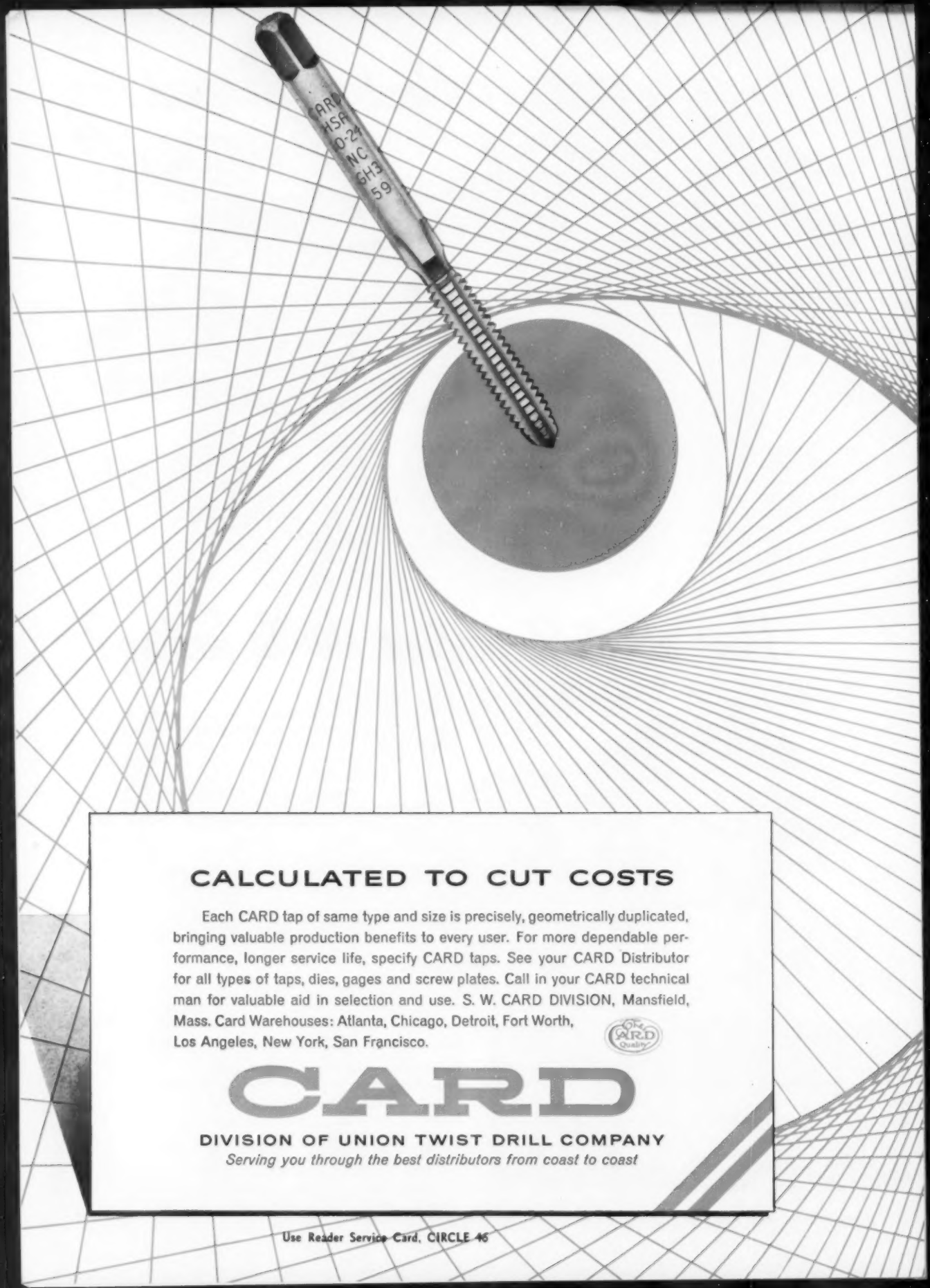
Bellows-Valvair, Division of IBEC, Akron 9, Ohio

Please send me full details on Bellows-Valvair Air-powered Index and Work Feeders. TE-1160

Name _____

Company _____

Address _____



CALCULATED TO CUT COSTS

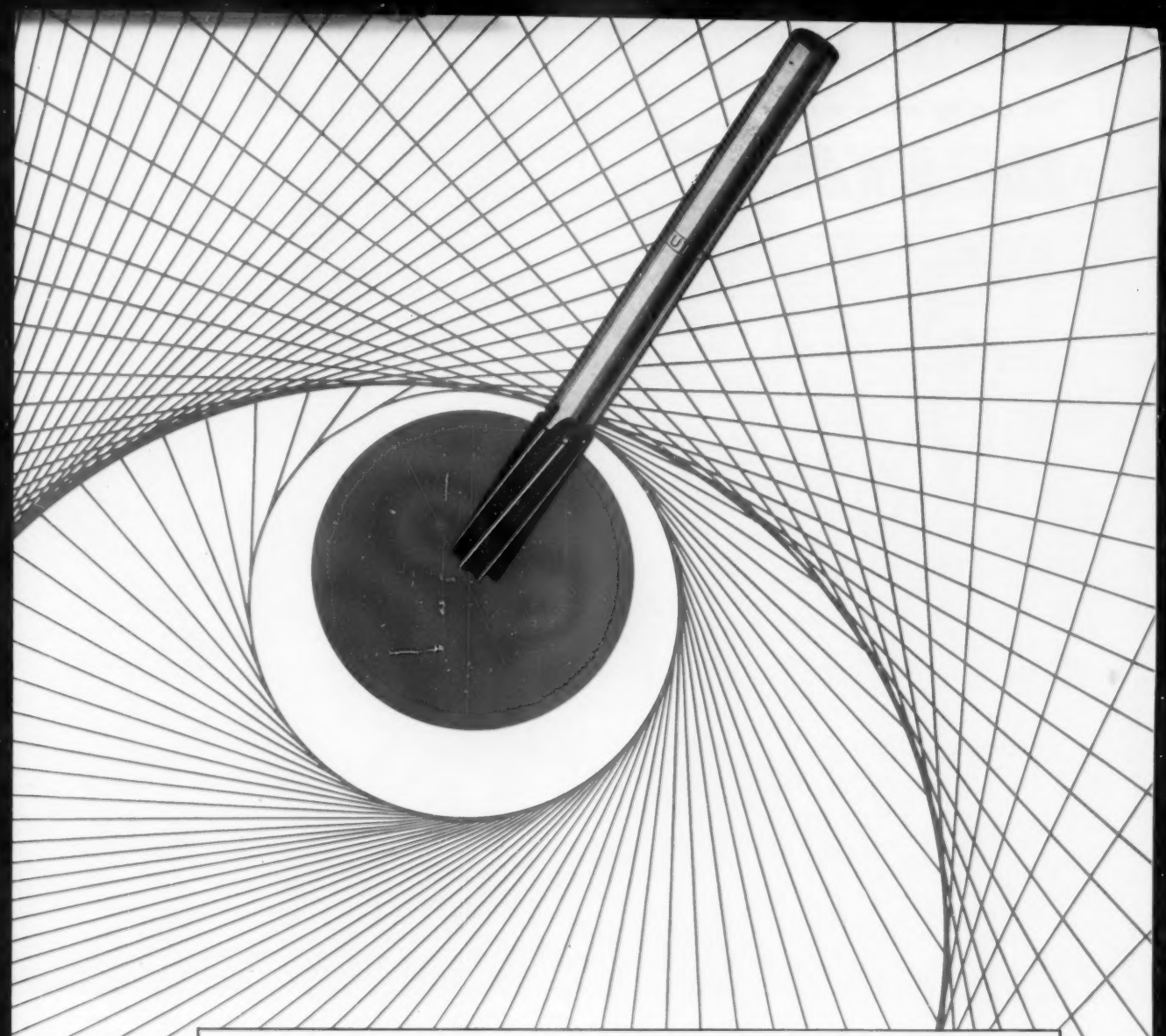
Each CARD tap of same type and size is precisely, geometrically duplicated, bringing valuable production benefits to every user. For more dependable performance, longer service life, specify CARD taps. See your CARD Distributor for all types of taps, dies, gages and screw plates. Call in your CARD technical man for valuable aid in selection and use. S. W. CARD DIVISION, Mansfield, Mass. Card Warehouses: Atlanta, Chicago, Detroit, Fort Worth, Los Angeles, New York, San Francisco.

CARD

DIVISION OF UNION TWIST DRILL COMPANY

Serving you through the best distributors from coast to coast

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GEOMETRIC PROGRESSION SYMBOLIZES PRECISE DUPLICATION

CALCULATED TO CUT COSTS

UNION cutting tools are duplicated with the accuracy of geometric progression. For example, all UNION reamers of the same size and type are identical with each other. Precise duplication like this can help you save production time and money. Specify UNION reamers, drills, milling cutters, end mills, gear cutters, hobs, carbide tools, and inserted blade cutters. Available nationally through UNION Distributors and stocked in UNION warehouses in Atlanta, Chicago, Detroit, Fort Worth, Los Angeles, New York City, and San Francisco. UTD

UNION

UNION TWIST DRILL COMPANY, Athol, Massachusetts

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You can do more with

DELTA



NEVER BEFORE—UP FRONT CONTROL WITH ONE HAND OPERATION

Unique pilot wheel control is mechanically integrated with the clutch control, allows operator to engage power feed with a simple wrist movement of one hand. Without any adjustments, operator can use rapid manual approach then power feed, skip drilling technique, straight power feed or straight manual feed. There are four feed ratios—.004, .006, .009 and .012 ipr—with each of five available spindle speeds.

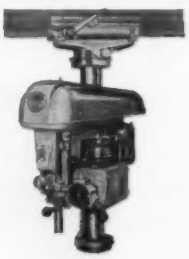
NEVER BEFORE—SUCH A COMPLETE CHOICE OF MODELS



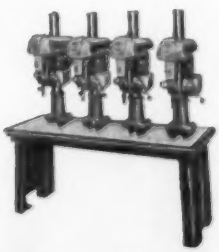
Floor model



Bench model



Overhead model

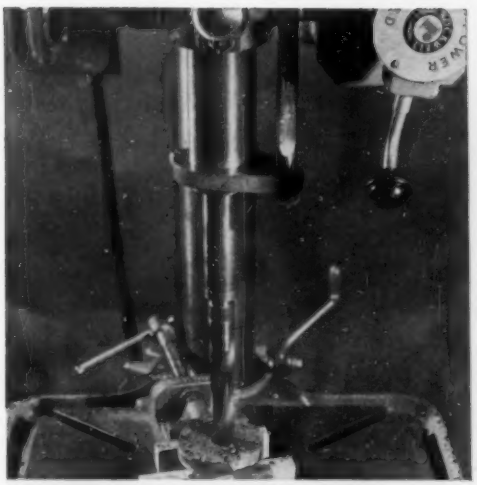


Multiple spindle model

ROCKWELL ANNOUNCES . . .

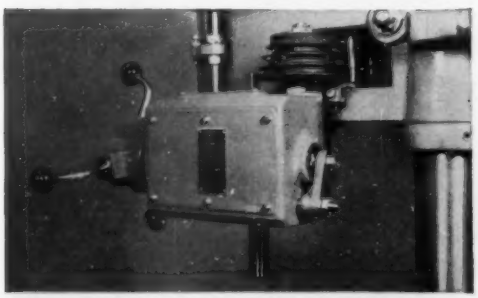
NEW POWER FEED

on famous DELTA 20" drill presses



NEVER BEFORE—"JOB TAILORED" DRILL POINT PRESSURE

A lathe-type cone clutch enables operator to adjust drill point pressure from 0 to maximum capacity of machine to permit power feeding on a production basis through a wide range of hole diameters. It furnishes power and thrust for drilling holes up to 1", yet delicately handles drills down to 1/16" diameter. Torque sensitive adjustability feature stops feed when overloaded—avoids drill breakage.



NEVER BEFORE—REMOTE CONTROL AND AUTOMATION

Actuating plunger, an extension of the clutch shaft, permits remote control which frees operator from manual effort. The power feed can be electrically, hydraulically, pneumatically, or mechanically interlocked with other machines or synchronized with devices such as rotary tables, clamps and work feeds for semi or full automatic operations.

Now Delta brings you advantages NEVER BEFORE AVAILABLE on a standard drill press—with the most advanced development in mechanical power feeds. Every model in the new Delta 20" drill press line offers power feed that gives you: *a front mounted pilot wheel for effortless one hand operation; infinitely adjustable drill point pressure; built-in feature that permits remote control or interlocking with automation devices.*

With the flexibility of feeds afforded by "flick of the wrist" control, operator's work is limited to loading, unloading, and actuating the tool. You get the adaptability of a power tool with the ruggedness, precision and capacity of a machine tool. Capable of handling production metalworking jobs done by machines costing much more, these new Delta power feed drill presses provide a simple, low cost method of increasing productivity and improving drilling quality.

Thoroughly tested through a rugged trial of 750,000 drilling cycles, Delta's new power feed line offers many other outstanding features and NEVER BEFORE AVAILABLE benefits that you cannot appreciate unless you see them demonstrated IN ACTION. Let your Delta Industrial Distributor show you how the 20" power feed drill press can help you cut costs (he's listed under "TOOLS" or "MACHINERY" in the Yellow Pages). Meanwhile, for FREE brochure giving details and specifications *plus* information on how to add New Power Feed to your present Delta 20" drill press, write: Rockwell Manufacturing Company, Delta Power Tool Division, 620F N. Lexington Avenue, Pittsburgh 8, Pa. In Canada: Rockwell Manufacturing Company of Canada, Ltd., Box 420, Guelph, Ontario.

DELTA INDUSTRIAL TOOLS

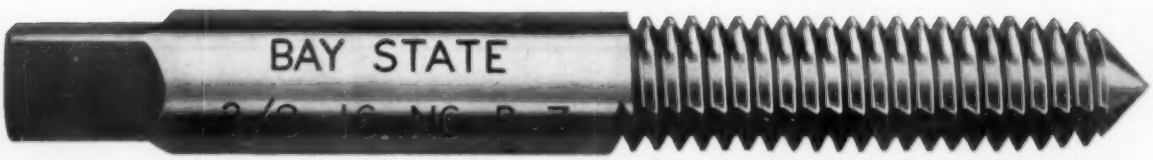
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INTERNAL THREADS...COLD FORMED ...WITHOUT CUTTING, WITHOUT CHIPS

FORM-TAPPING, a revolutionary development, cold forms internal threads by a flowing displacement of material in such metals as copper, brass, aluminum, die castings, lead, leaded steels and other ductile materials.

The use of a FORM TAP for blind holes in these materials reduces tap breakage . . . and more important . . . eliminates costly chip removal.

For more information about FORM TAPS and for the best in taps and dies, call your BAY STATE distributor.



On the nearby shelves of your Industrial Distributor

BAY STATE TAPS

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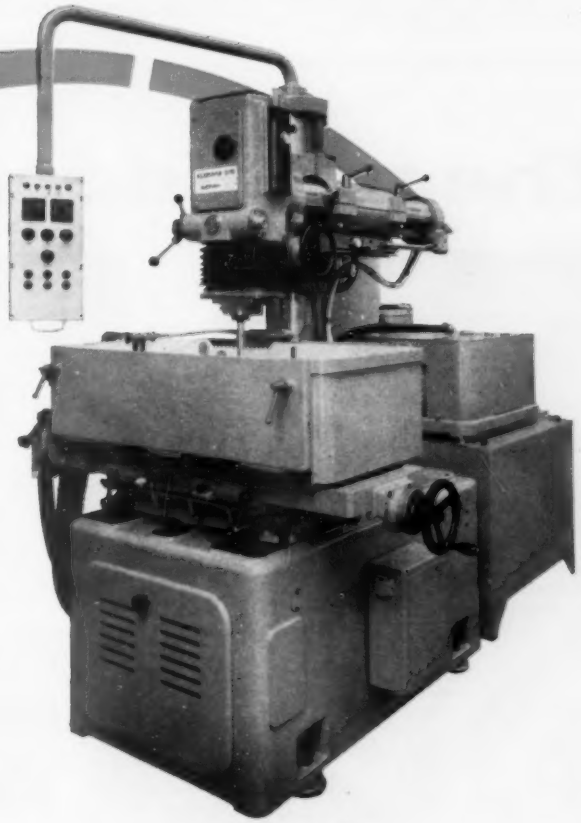
Stockrooms: New York (Englewood Cliffs, N. J.) • Atlanta • Cleveland Detroit • Chicago • Dallas • Los Angeles • San Francisco

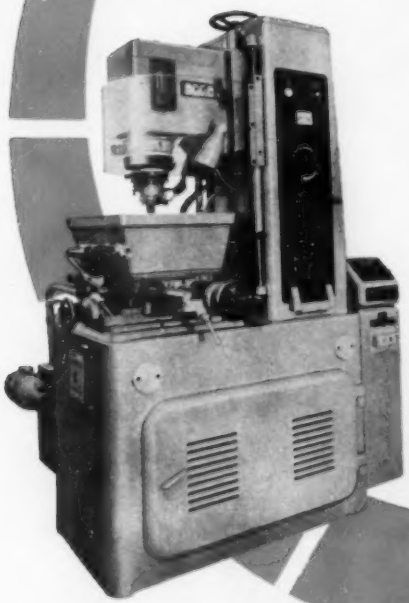
ELERODA D1 & D15

ELECTRICAL DISCHARGE MACHINES

D-15

High Speed: 15 cu. inches per hour.
Unique Versatility: Machines are tailored to fit user's applications.
Hydraulic Servo: Electric Impulse Generator (EPL-500)





D-1

The only high precision erosion machine to work and locate with ± .0002". Surface Finish Guarantee 10 micro inches.

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Precision lathes for tape, tracer, or operator control

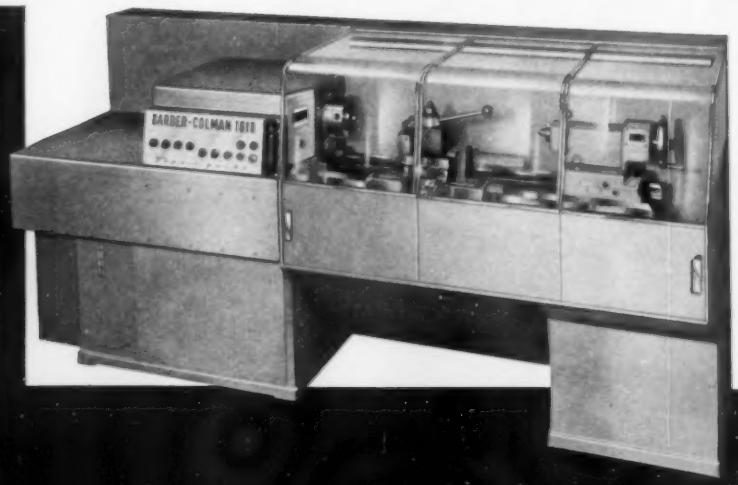
Here you see the core of the new Barber-Colman lathe line. To prove the *new* ideas claim, take just two examples, the Tape-r-guide (directly below) and the 1610 tracer lathe (lower right, opposite page).

News about the Tape-r-guide? Without complex electronics, with just electromechanical controls, this machine can do cutoff and boring as well as internal and external step-turning, smooth tapers, and even some radii. Simplicity itself, it does its work with a single-point tool . . .

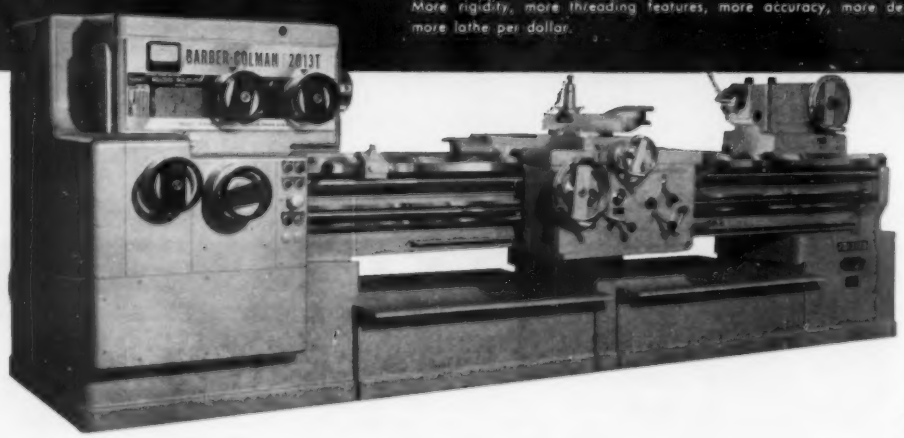
The new ideas in turning

new

NEW Tape-r-guide (16" and 20"), first basically mechanical lathe with fully integrated 8-channel binary code control system. Automatically performs stop-start, positioning, speed adjustment, and feed change functions; machines all practical tapers without "hunting" or step formation; produces simple radii; cuts chamfers without special tools, performs cutoff and boring operations and machines at 90° to the work axis — all without feedback or complex electronics. Low capital equipment investment — simple, low-cost operation and maintenance.



NEW 2013, 36-speed lathe (21" and 25") — All-new, geared-head precision lathe for high-speed production or toolroom turning . . . used in production shops with throw-away insert tools at speeds up to 750 sfpm. For fast, accurate production of medium- and short-run jobs. Spindle speeds to 1500 rpm (200 rpm optional); 66 thread cutting and feed changes; 400-lb. two-speed tailstock; separate lead screw and feed shaft. More rigidity, more threading features, more accuracy, more design refinements — more lathe per dollar.



new

completely controlled by the tape.

And about the 1610 tracer? This is the "specialist," a concept which for the first time strips off the toolroom equipment and offers a facing and turning lathe that is frankly a production tool. Tracer control multiplies its productivity by making it semiautomatic.

Both these new machines are innovations, and are signs of the unencumbered thinking that goes on at Barber-Colman. It is part of the heritage that has brought to Barber-Colman precision lathes such important design advantages as sealed gearboxes, controls that are simplified and grouped, hardened and ground bedways, the use of precision antifriction bearings, and universal automatic lubrication.

You can continue to expect significant design contributions such as these in the lathes Barber-Colman will build in the years to come. But meantime, take advantage of the increased productivity of the machines offered today.

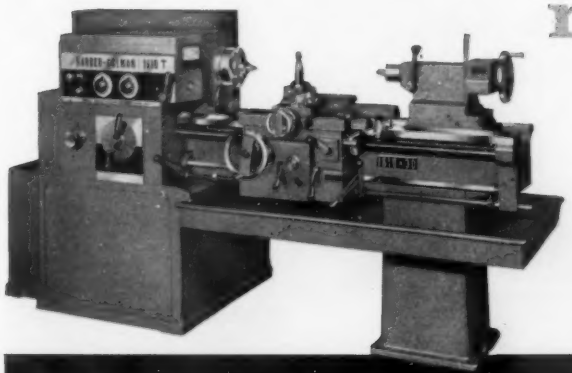
A good way to start is to call your Barber-Colman representative.

Barber-Colman Company

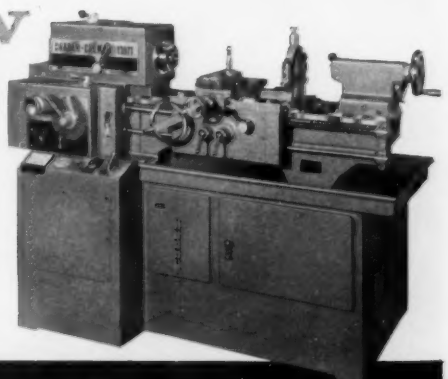
BARBER COLMAN

113 Loomis St., Rockford, Illinois

are from Barber-Colman



new



NEW 1610T toolroom lathe (16½" and 20") — The lathe with the "toolroom touch." The minute you push the start button and grab the handwheel, you feel the difference toolmakers' look for. Try the speed change dial for fast facing or a light finishing cut on the OD. Smooth, silent, fast acceleration under load — infinitely variable speeds to 1500 rpm in the high range.

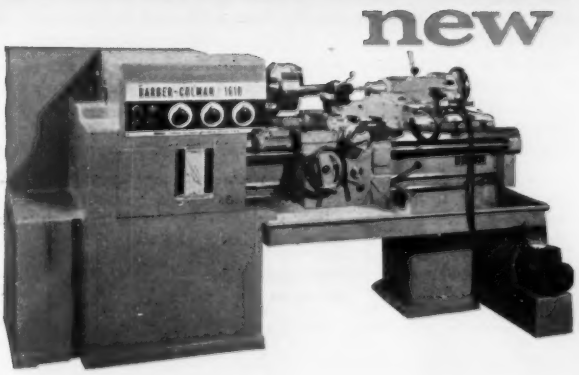
NEW 1610 specialist (16½" and 20") — Proven new concept reduces both capital equipment and operating costs. For high-speed turning, facing, and boring. Class B operators readily become proficient at producing accurate nonthreaded parts up to 100% faster. Infinitely variable spindle speeds to 1500 rpm; infinitely variable power feed to both carriage and cross slide; five-position turret-type longitudinal feed stop — reduces skill requirements and speeds operation.

NEW 1307T toolroom lathe (13") — High capacity and timesaving controls combined with super precision. Infinitely variable speeds to 3000 rpm in belt drive can be changed under load. Combines extra capacities (13" swing and 24" between centers) with extra quality: selected Class ABEC-7 super-precision spindle bearings; ground-from-the-solid actuating screws; antifriction bearings on all shafts; Meehanite castings; hardened-and-ground headstock gears; splined shaft connections.

NEW 1610 tracer lathe (and 1610-13) — Can be purchased with hydraulic tracer for about the same price as a toolroom lathe of the same rated capacity and quality. Real cost-busting combination of "specialist" lathe and tracer control capable of holding diameters within 0.001".



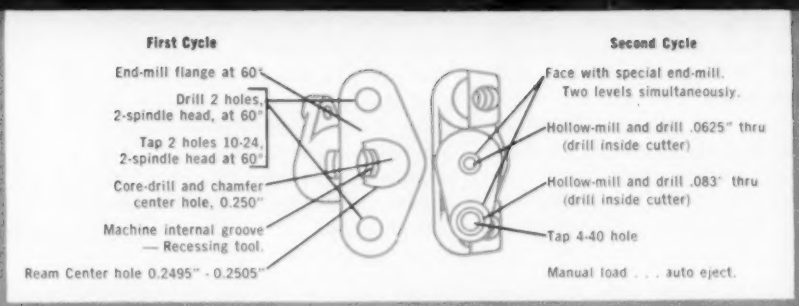
new

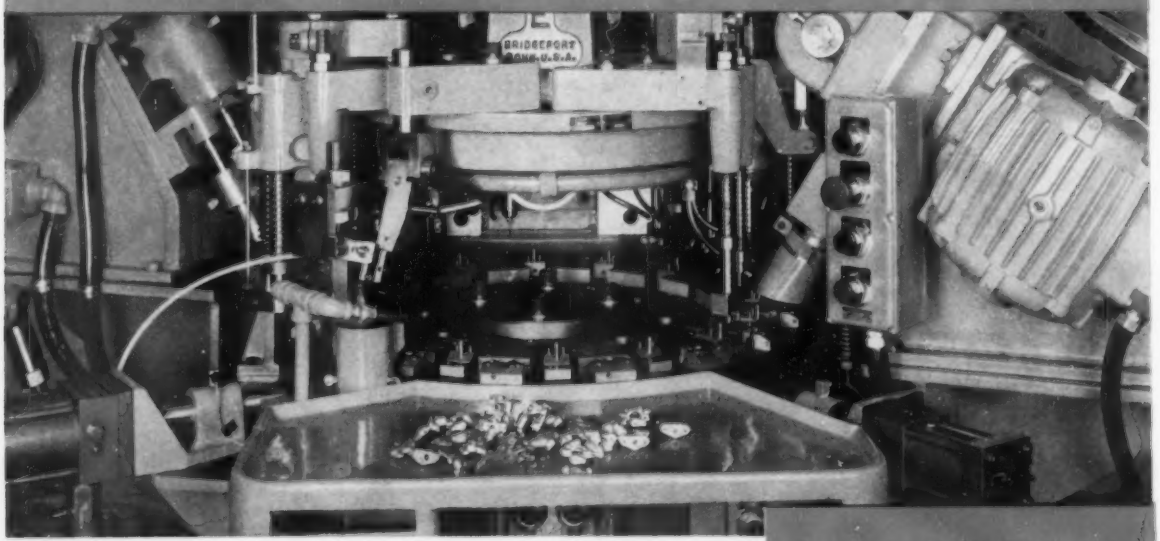


new

Bodine CASE HISTORY NUMBER 52







A HALF-PRICE BARGAIN
in streamlined production!

These small thermostat valve bodies are components of the automatic transmission units for new compact cars.

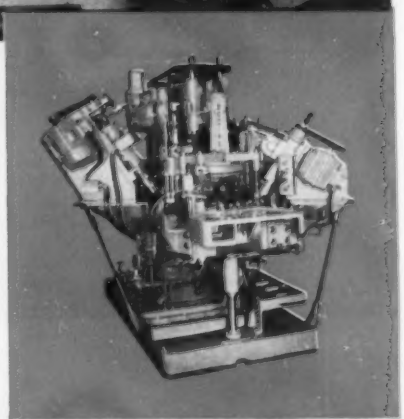
One of the world's largest makers of auto transmissions ordered the Bodine Basic Unit, equipped and tooled to perform 15 separate operations on the part in two consecutive, simultaneous work cycles . . . 8 operations on the first and 7 on the second, as shown in the above sketches.

For this job, Bodine methods offered a number of important advantages not available in alternative proposals . . . including mechanical actuation, extremely flexible and versatile tooling, dependably close adherence to tolerances, compact design and low initial cost.

The Bodine 48-30 machine, in fact, is about *one quarter* the size of typical hydraulic or pneumatically controlled units. It was placed on the customer's production line at approximately one *half* the cost of such units. Being controlled from a single main shaft and cam system, operating adjustments are more easily made and maintenance is at a minimum. Famous Bodine ruggedness assures long-run economy.

There are very few jobs in this general category that cannot be handled to unusual advantage on such Bodine basic machines with our standardized tooling methods. Hence, before considering costly "specials" it will surely pay you to consult us. Send your prints or samples for study . . . without obligation . . . write Dept. TE-11 today.

Production: 500 pieces per 50-minute hour with machine running at 10 strokes per minute.



THE Bodine CORPORATION
BRIDGEPORT 5, CONNECTICUT
AUTOMATIC DIAL TYPE DRILLING, MILLING, TAPPING, AND SCREW INSERTING MACHINES

26D60



Here's how one company tests its products with air. This air circuit of Schrader Products at the Sprague Meter Company in Bridgeport, Connecticut, automatically clamps meter ports airtight, lowers meter into water, and fills it to test pressure. Operator looks for telltale bubbles from leaks, then presses lever to raise meter automatically. Says the Plant Manager: "This used to be a slow, arduous process. Now a meter's in the water, under pressure, in less than a second."

MANUFACTURER SETS UP CRITICAL TEST IN LESS THAN ONE SECOND— WITH SCHRADER AIR PRODUCTS

As products grow more complex and precise, many manufacturers are *simplifying* their operations—with air cylinders, valves, fittings and simple schematic planning. They're installing their own circuits, as this manufacturer did, or letting Schrader experts help. For example, Schrader Air Products can inspect, test, assemble, package – do work faster, more accurately – save effort and money.

Never forget air can make almost any motion human hands can – push, pull, hold, position, or move repetitively. And air doesn't get tired – has more powerful muscles. Maintenance? Almost nil.

Take full advantage of your air power by automating with Schrader – the most complete line of Air Cylinders, Valves, and Accessories. Schrader engineers have experience and know how to help you cut your operating costs.

Select your automating equipment from the full Schrader line. Your Schrader distributor can help you pinpoint what you need. For more data, write:

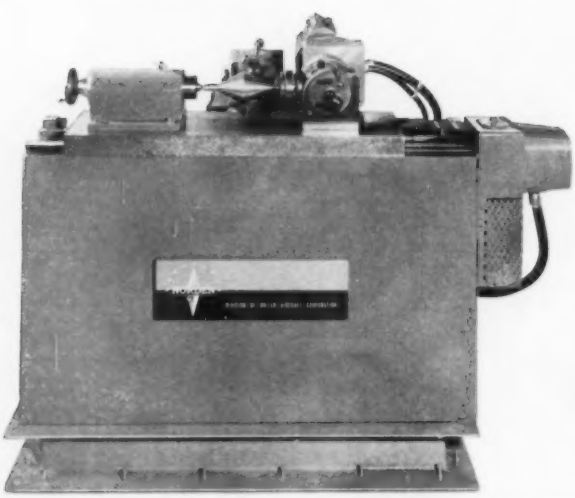
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Division of Scovill Manufacturing Company, Incorporated
462 Vanderbilt Avenue, Brooklyn 38, N. Y.

QUALITY AIR CONTROL PRODUCTS

NORDEN Modumatic Systems for Numerical Inspection

For automatic measurement of actual dimensions or deviations from nominal





Composite view of inspection machine and electronics

Norden's new concept in numerical control applies absolute digital techniques to a wide variety of inspection problems. The Norden system gives digital position information of actual part dimensions as well as deviations from nominal.

NORDEN SYSTEM

INPUT

Automatic Tape Control—Standard 1"—8 channel paper or Mylar tape

Manual Numeric Control—by ten position rotary switches—one switch per digit in decimal form

Manual Jog Control—of position servo motors by push buttons on control panel

OUTPUT

Visual Decimal Display—continuous display of absolute position, part dimensions or deviations in any axis

Printout—typewriter variable format

Punched Tape

Output can also be designed to meet specific requirements.

The modumatic inspection system also features full range origin selection for fast and accurate part set-up. The entire system is constructed from modules so that you may select the exact features required for your application.

For more information about Modumatic Inspection Systems or other Norden numerical control systems, contact your nearest representative—400 Main Street, East Hartford, Connecticut, JAckson 8-4811—11 West Monument Ave., Dayton 2, Ohio, BAldwin 8-4481, or write us at the address below.

NORDEN DIVISION OF UNITED AIRCRAFT CORPORATION
DATA SYSTEMS DEPARTMENT
3501 HARBOR BOULEVARD, COSTA MESA, CALIFORNIA



There's more to the buy than meets the eye

How do I know? We had a finish problem in reaming cast steel. Best finish we were getting was 150-175 micro-inch. We needed 60 or better. A W&B Service Engineer came in with one of their 1-1/16" Chucking Reamers. He checked feeds and speeds—finally came up with .011 per revolution and 60 SFM. He recommended a secondary grind on the chamfer to assure clearance, then added a second chamfer of 67½°. We were able to get and maintain a reamed finish of 40-50 micro-inches. At the end of the day, the operator was getting all good parts and saving substantial time per piece. In a case like ours, W&B's technical help, service and consistent reamer quality really convinced me that initial price is merely one factor. Find out for yourself . . . test W&B tools in *your* plant under *your* conditions. Call them in direct or through your industrial distributor. Do it today. See if *you* can't get better results.

W&B

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WHITMAN & BARNES

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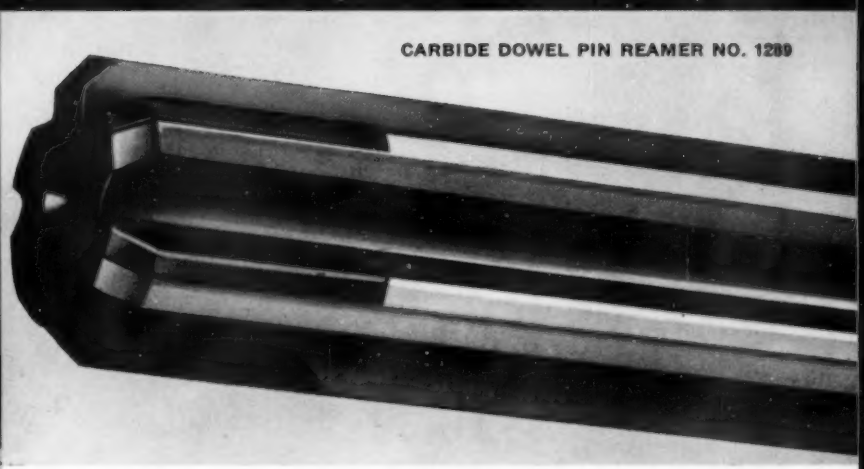


CARBIDE DIE DRILL NO. 1500

Reduce Tip Failures with W & B Perma-Braze Carbide Tools



CARBIDE DOWEL PIN REAMER NO. 1289



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FREE LITERATURE
on carbide tools—write today!

Perma-Braze is an advanced process pioneered and perfected by Whitman & Barnes that enables carbide tips to be brazed with a specially developed high temperature alloy at the same time the high speed bodies are hardened. The result is uniform body hardness and carbide tips that will not loosen due to braze melting. Your payoff is greatly reduced tip failures . . . less machine down-time . . . longer tool life. You get lower tooling costs *and* a more efficient operation. Ask your W&B distributor about Perma-Braze carbide tools today!

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"MAKERS OF FINE TOOLS SINCE 1848"

DRILLS AND REAMERS

40000 PLYMOUTH ROAD • PLYMOUTH, MICHIGAN

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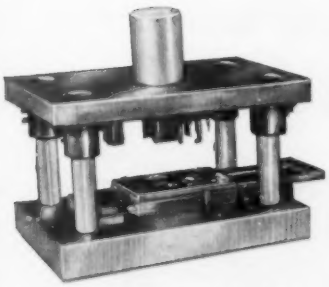


WEILAND TOOL AND MANUFACTURING CO. GETS

25% MORE PARTS PER GRIND

WITH PRECISION DANLY 4-POST DIE SET

In mid-'59 Weiland Tool and Manufacturing Company of Chicago replaced a worn, 7-station, progressive die to continue production of a standard latch part. The new die was built to identical specifications, except that it was mounted in a 4-post precision Danly die set instead of a 2-post set as previously used.



Latch handles are stamped out in this 7-station progressive die mounted in a precision Danly 4-post die set.

The number of pieces per die grind produced on the new die far exceeds the output from the earlier identical die. Weiland Tool estimates that, conservatively, 25% longer die life is directly attributable to the extra precision and alignment of the Danly 4-post die set.

Benefits from this longer die life are not limited to a lower per part cost of dies. In addition, Weiland Tool is avoiding considerable downtime for die sharpening and set up, and they are freeing diemakers and set-up men from unnecessary maintenance activities.

Here is proof that the finest die set obtainable, is the lowest cost insurance for your expensive dies. May we show you how Danly die set precision can save money for you. Write for the informative folder "The Importance of Die Set Precision."



Branches and Distributor Assembly Plants in all Toolmaking Centers

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DANLY®

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You Name the Job...



A MANHATTAN ABRASIVE WHEEL
WILL REMOVE MORE METAL, FASTER—AT LOWER COST!

- ROUGHING WHEELS
- FINISHING WHEELS
- CUT-OFF WHEELS
- DIAMOND WHEELS
- SAFETY BACK FLARED CUPS
- *NEW* FAST CUT MOLDISCS
- *NEW* LONG-LIFE MOLDISCS
- *NEW* SNAGGING WHEELS FOR AUTOMATIC BILLET GRINDING

ARE YOUR NEEDS LISTED HERE?

You Can Get a Manhattan Abrasive Wheel Custom-Designed for Any of These Jobs.

Foundry Snagging—Billet Surfacing
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Foundry Cutting—Standard and Reinforced Wheels
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ABRASIVE, GRAIN SIZE, HARDNESS, STRUCTURE, BOND—EVERY WHEEL COMPONENT IS SELECTED FOR YOUR CUTTING AND GRINDING REQUIREMENTS. SEE YOUR MANHATTAN ABRASIVE WHEEL SPECIALIST.

SPECIFY* MANHATTAN *FOR MORE OUTPUT PER MAN HOUR—

"MORE USE PER DOLLAR"

RM1065

ENGINEERED RUBBER PRODUCTS ..."MORE USE PER DOLLAR"

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WRITE TO ABRASIVE WHEEL DEPARTMENT

MANHATTAN RUBBER DIVISION—PASSAIC, N.J.

RAYBESTOS-MANHATTAN, INC.

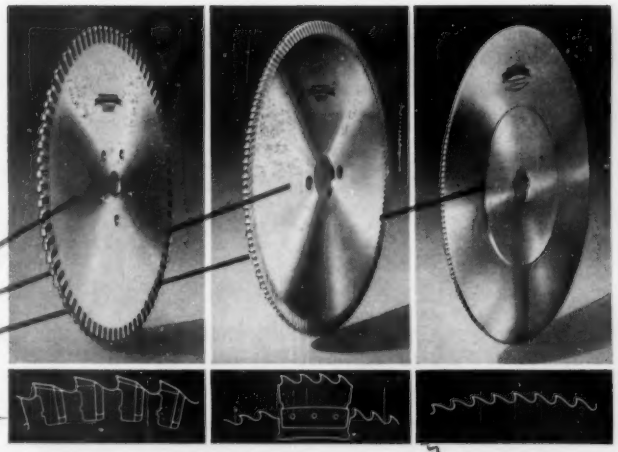
Do you cut ferrous metals? If so, Simonds has three basic saw designs for you:

INSERTED TOOTH METAL SAWS

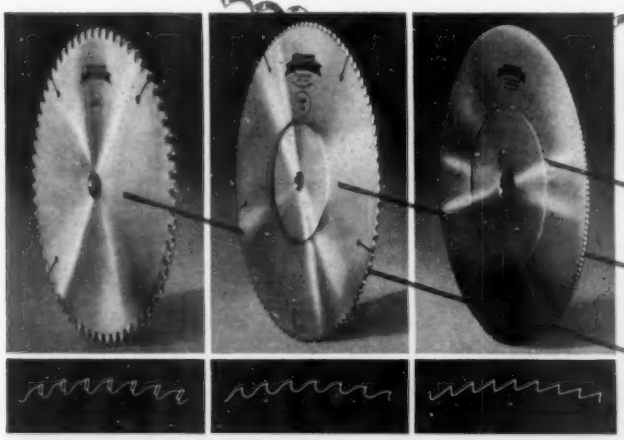
SEGMENTAL SAWS

SOLID TYPE SAWS

Available in High Speed and Semi-High Speed Steels



There's a SIMONDS Circular Saw Exactly Right for Your Metal Cutting Job



If you're cutting non-ferrous metals, Simonds offers you:

SOLID STEEL SAWS
Available in "Si-Maloy", in High-Speed Steel for cutting where extreme abrasiveness is present, and in Semi-High Speed Steel.

HIGH SPEED STEEL, HARD RIM SAWS
Hard cutting edge, soft center gives you long life coupled with safety.

CARBIDE TIPPED SAWS
for cutting aluminum and magnesium, as well as other non-ferrous metals

No matter what kind of metal you're working, there's a quality Simonds blade just right — a blade that means faster, cleaner cuts, longer blade life and maximum performance.

Find out how a Simonds Circular Metal Cutting Saw can mean important savings for you.

SIMONDS SAW AND STEEL CO.
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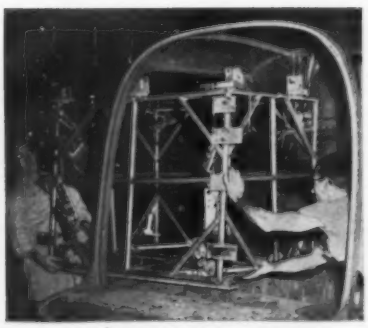
DOW | *Now in magnesium and aluminum*

MAGNESIUM TOOLING PLATE CUTS TOOLING COSTS FOR MAJOR INDUSTRIES

Magnesium tooling plate and extrusions have become accepted as essential tooling materials during the past six years by such cost-conscious industries as automotive, aircraft, missile, machine tools, and electronics. No other tooling material approaches magnesium's unique combination of cost-cutting properties . . . lightness, machinability, flatness, rigidity. You get more metal per pound with magnesium than with any other metal!



Unmatched machinability cuts machining costs.



Magnesium assembly jig is easily handled by two men.

BEST PROOF of magnesium's acceptance as a tooling material is its actual use for: assembly jigs; trim and drill jigs; checking fixtures; templates; base plates; test equipment. Magnesium's acceptance is growing for a very good reason—its properties mean lower tooling costs, better all-around results!

LIGHTWEIGHT magnesium tooling is easy to build, use and handle, reducing fabrication and labor costs. This is the lightest of all structural metals, weighing only one-quarter as much as steel, one-third less than aluminum. Magnesium reduces worker fatigue and accidents, too.

MACHINABILITY. Magnesium is the easiest to machine of all structural metals, for all machining operations . . . sawing, milling, planing, boring, tapping and threading, etc. For example, cutting speeds of up to 5000 feet/minute and cuts of 0.500" in depth are often used in turning. Even at these speeds and cuts, tool wear is less than with other metals.

FLATNESS. Lightweight tooling plate now has closer flatness tolerances than ever before—so close, in fact, that it can be used *as purchased* for nearly every tooling purpose. Surface machining is not necessary! This plate is rolled and stress relieved, and magnesium's dimensional stability *keeps* it flat.

SQUARE MAGNESIUM TUBING is the latest magnesium extrusion shape. This useful form fills out the complete line of extrusions which includes channels, tubing, and most other standard structural shapes.

• • •

Economical magnesium tooling materials have been proved and accepted by the country's major industries. Why not put their advantages to work for you? For a copy of the fact-filled booklet "Magnesium Tooling Plate Shop Manual," or for more information, contact the nearest Dow sales office or write THE DOW METAL PRODUCTS COMPANY, Midland, Michigan, Merchandising Dept. 1031FJ11.



Auto checking fixture retains dimensional accuracy.



Square magnesium tubing is now available.

See "The Dow Hour of Great Mysteries" on TV

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New

FOR THE FIRST TIME... A PRACTICAL INEXPENSIVE TAPPING ATTACHMENT FOR USE ON ANY DRILL PRESS



THE SUPREME VersaTAPPER . . .

0—½" Tapping Head

for $63

- COMPLETE WITH TAP CHUCK
- BALL BEARING SPINDLE
- RUNS IN OIL
- MINIMUM TAP BREAKAGE

ON-AND-OFF A DRILL PRESS IN SECONDS!



Yoke of VersaTAPPER is adjusted to reach to drill press column. Adjustment need not be repeated unless tool is used on a different model drill press.



Entire unit is chucked to the drill press chuck. Alternate model has No. 2 Morse Taper Arbor for direct installation to drill press spindle.



A Supreme Accutap Tap Chuck is standard equipment, and with its extra collet, handles all taps from 0 to ½". Accutap is highly regarded for its accuracy.

Here's the Tapping attachment for drill presses that does everything! Taps in any material, at any size up to one-half inch, and does it easily, efficiently, economically. Arrange a test in your plant soon—you'll be glad you did. Two models to choose from: *Model 6100*, with straight shank. (see photo). *Model 6200*, with No. 2 Morse Taper Arbor. Each model just *sixty-three dollars*, complete.

Supreme VersaTAPPER

DRILL PRESS TAPPING ATTACHMENT

See VersaTAPPER and other great Supreme products in action at the Western Tool Show

For fast, intelligent, local service, order from your industrial supply distributor.

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GUARANTEED BY THE MAKERS OF
SUPREME BRAND CHUCKS



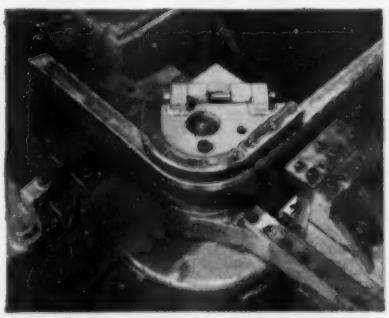
SUPREME PRODUCTS CORPORATION
2222 S. Calumet Ave.
Chicago 16, Illinois

PRECISION ASR PRODUCTS



HUGE ATOM SMASHER COIL ACCURACY HELD TO ±.010" ON PINES MACHINES.

Precision bending over 400 tons of pure extruded copper bar into magnet coils for the Alternating Gradient Synchrotron at Brookhaven National Laboratory was a tough job because of the precision required. Coil bending was done at National Electric Coil Division of McGraw Edison Company, Columbus, Ohio, on a Model 2 Pines Bender. Copper bars 7/8" x 1 19/32", with a 3/8" center hole extruded the full length, were edge bent to 90°. Four radii between 1 1/2" and 6 3/8" form the various coil sizes. Precise bend accuracy made possible nesting of the turns for assembly into a completed coil. On the rectangular turns, ranging in sizes to 13 1/2" x 93", width dimensions between bends were held to ± .010"and length to ± .015". Center hole distortion was controlled to within 1/16" on the diameter and ± 2 1/2% in area. Tooling includes a hinge-type bending form and lap-over type clamp and pressure dies.

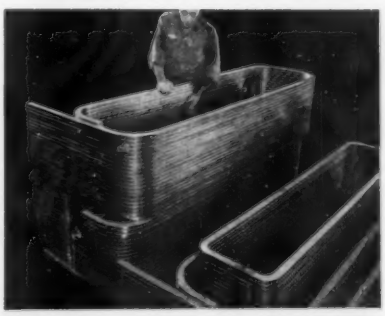


Precision tooling includes split-type bending form for fast, efficient parts handling.

Bending can be the profitable solution for you...

. . . as it has for hundreds of metalworking plants that have applied Pines methods, machines, and tooling to bending a wide range of tubing, pipe, extruded or rolled shape parts. Increased production . . . improved quality . . . reduced costs have been achieved on long and short runs, large and small parts. Analysis of your metal fabricating procedures may reveal unusual opportunities for cost-cutting application of this fast, accurate metal forming method. Call on Pines' experience and skill . . . always available to assist you without obligation.

GET THE COMPLETE PROFIT STORY . . . WRITE TODAY FOR FREE CATALOG AND OTHER CASE STUDY REPORTS



Finished turns bent to ± .010" width, ± .015" length accuracy, nest perfectly into completed coils.

PINES ENGINEERING CO., INC.

Specialists in Tube Fabricating Machinery

693 WALNUT • AURORA, ILLINOIS

PRODUCTION BENDING • DEBURRING • CHAMFERING MACHINERY

NEW

MODEL III

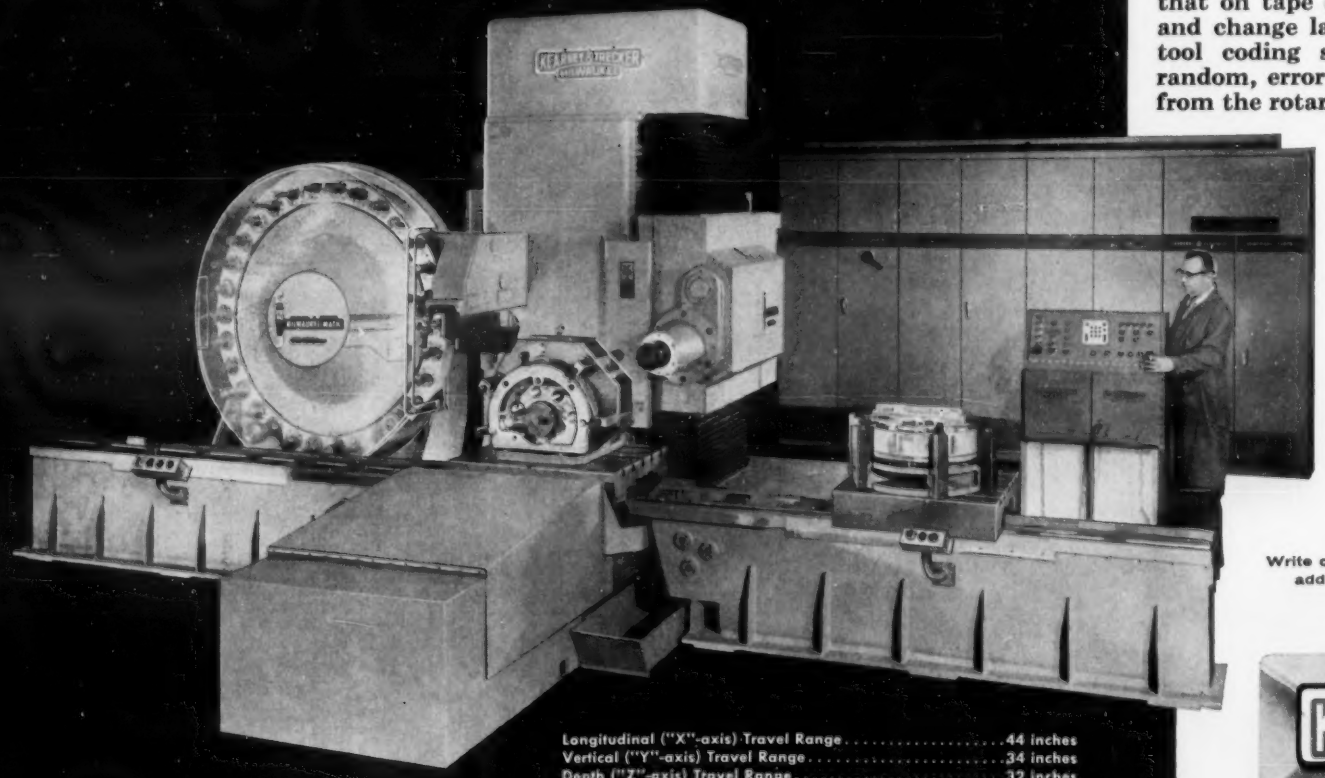
KEARNEY & TRECKER

MILWAUKEE-MATIC

WITH THE

AUTOMATIC TOOL CHANGER

that on tape command can automatically select and change large tools in 15 seconds. Exclusive tool coding system provides for the possible, random, error-free selection of 961 different tools from the rotary tool storage magazine.



This new, time-slashing, profit-producing MODEL III extends the *Manufacturing with* MILWAUKEE-MATIC *CONCEPT* to larger workpieces . . . combines high horsepower with high precision.

"*. . . almost human — only better — it doesn't make mistakes*" . . . "*I see it, but I still don't believe it*" — were typical of the comments made by experienced machine tool buyers, on seeing this pace-setting MODEL III in action here at the birthplace of the *Manufacturing with* MILWAUKEE-MATIC *CONCEPT*.

Longitudinal ("X"-axis) Travel Range	44 inches
Vertical ("Y"-axis) Travel Range	34 inches
Depth ("Z"-axis) Travel Range	32 inches
Work Pallets—Surface Area	28" x 36"
Automatic Index Table—to any of 360-1° positions	at 5 rpm
Rotary Tool Storage Magazine	30 tools capacity, plus one tool in spindle
Max. Tool Dia. Automatically Changed	6 inches

Tools can be added to, or removed from any position in the magazine at any time.

Write or call for complete information on this new addition to the MILWAUKEE-MATIC family.

Numerical Control Division

KEARNEY & TRECKER MILWAUKEE

KEARNEY & TRECKER CORP.

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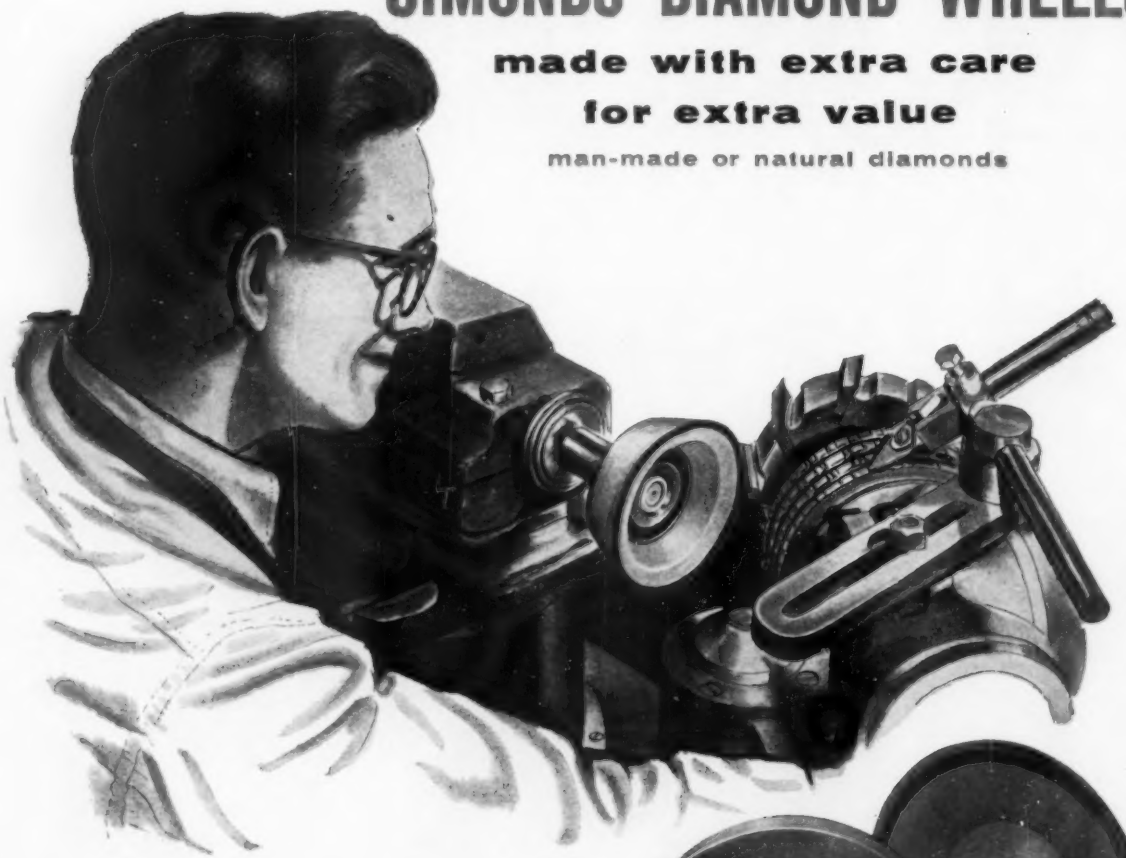
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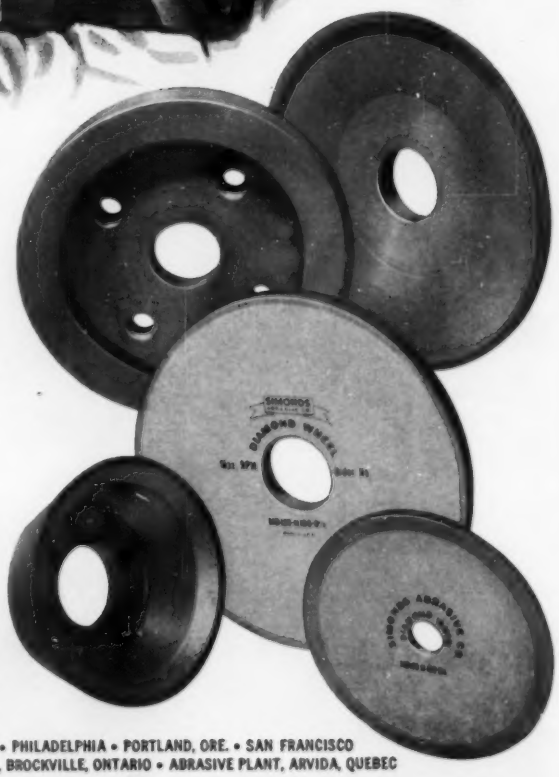
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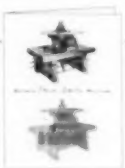


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- **Standard unit** features higher cam speeds, a provision to integrally mount rotary vacuum or pressure valves.
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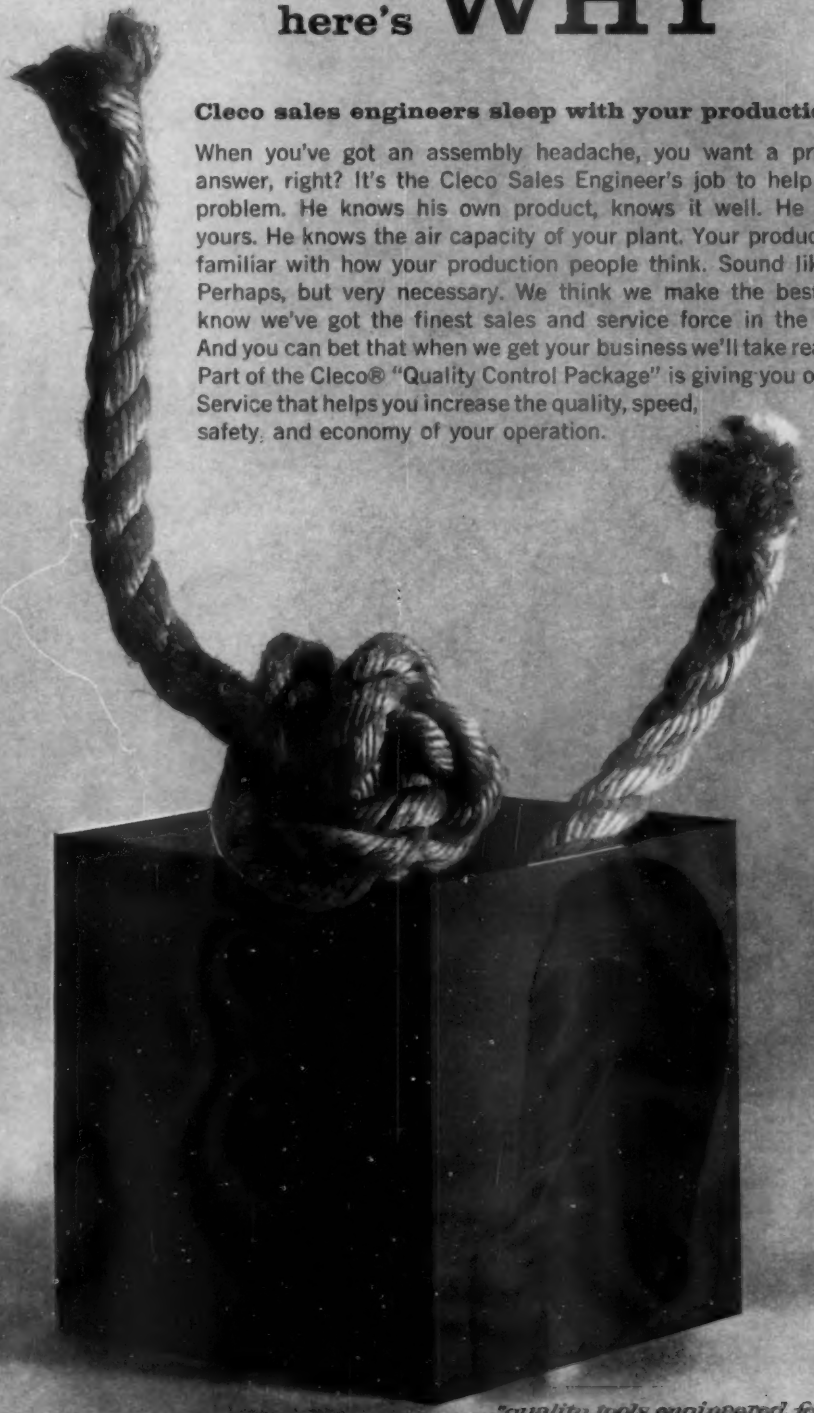
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A CASE-HISTORY REPORT

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Model
19-150 Air
Hydraulic Unit

PART: Hydraulic Control Sleeve

MATERIAL: 8617 Steel

REQUIRED: 78 Accurately Located Holes, Drilled at 60° Angle.

The Char-Lynn Company, of Minneapolis, Minnesota, is a well-known manufacturer of hydraulic equipment for farm machinery. Rapidly increasing demands for the Char-Lynn Power Steering Unit made it necessary for this company to increase its production rates for components like the control sleeve shown here. To accomplish this, Char-Lynn switched from single spindle machines to two- and six-spindle machines assembled from Model 19-150 Air Hydraulic Drill Units and other standard components produced by The Hartford Special Machinery Company. As a result of this change-over, drilling time for the 78 holes required has been cut from 42-84 minutes to 9-10 minutes . . . and per-piece costs have been cut from $5.65 to $1.80! Smooth operation with "no-surge" break-through has eliminated burring, so scraping is no longer necessary. Maintenance is only about one sixth of that previously required, and there have been no breakdowns that weren't "man-made."

Low-cost, high-production machines, assembled from standard Hartford Special Drill Units and custom-engineered to specific job requirements, provided the right answer to Char-Lynn's time- and cost-cutting needs—and they can do the same for you. Write today for complete information, outlining your parts production requirements.

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- push button operation
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- applicable for multiple spindles

write for folder #6016

SPECS:

Swing — 10″ dia. max., Stroke — 7⅛″ max.
Bore — .090″ dia. min., 3″ dia. max.



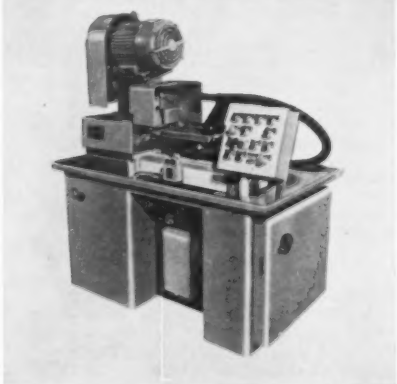
MODEL 410 PRECISION THREAD GRINDER

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- stark simplicity in set up and operation — push button control
- pre-packed work and wheel spindles — lubricated for life
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- all machine slides are on pre-loaded rollers for smooth accurate traverse

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SPECS:

Work Dia. — 4″ max., Thread Length — 10″ max.
Wheel Speeds — 2700 RPM



MODEL 6D PRECISION GUN DRILLING MACHINE

FEATURES:
- high penetration rates (12″ per min. not unusual)
- automatic cycling — push button control
- spindle distributes 12-15 gals. of coolant per min. at 2,000 PSI
- infinitely variable and constant feed rate

write for folder #6014

SPECS:

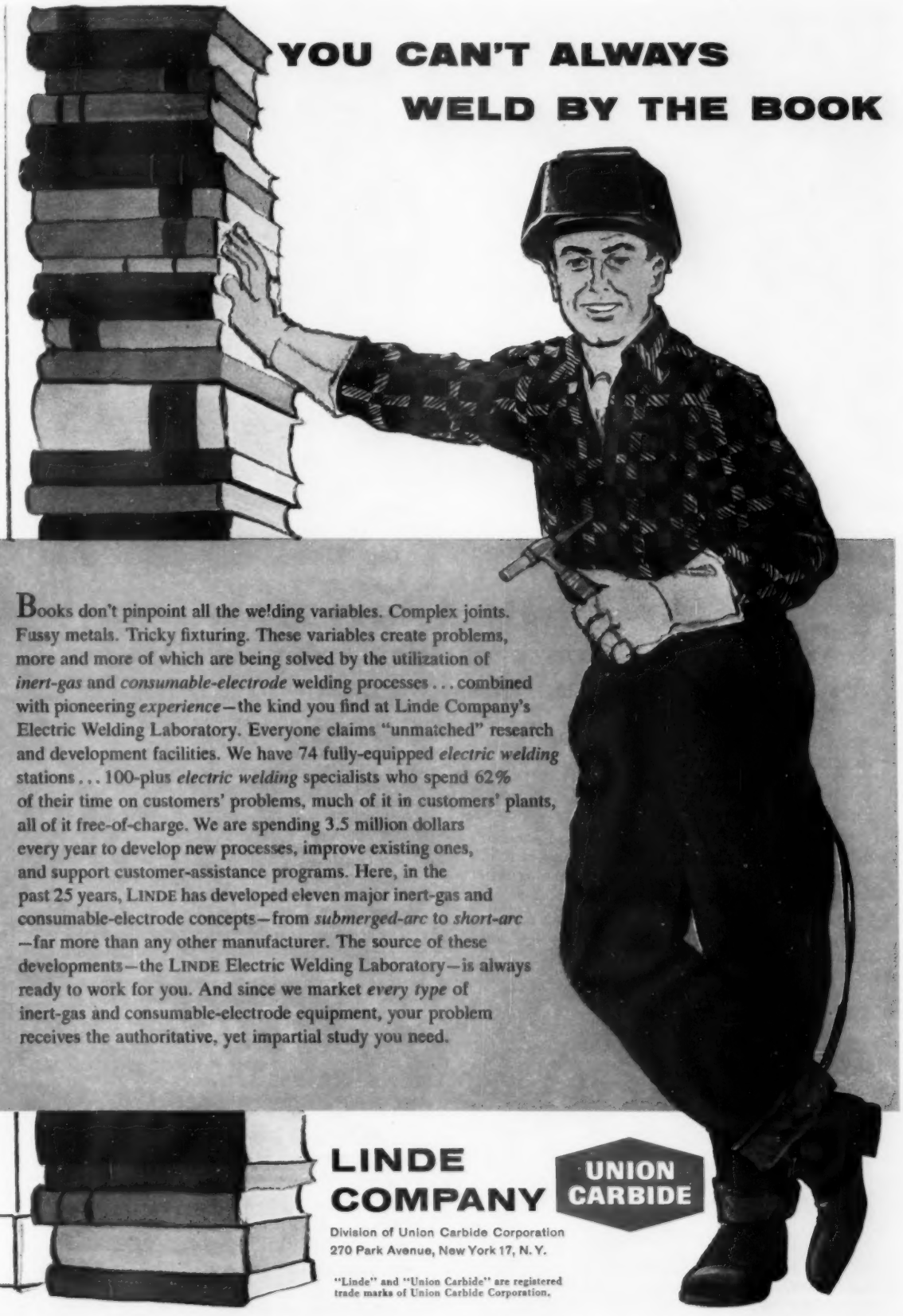
Spindle Speeds — 15,000 RPM, Max. Length of hole — 6″,
Dia. of hole — ½″ max., .074 min., Stroke — 7¾″ max.

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THREAD TOOL DIVISION

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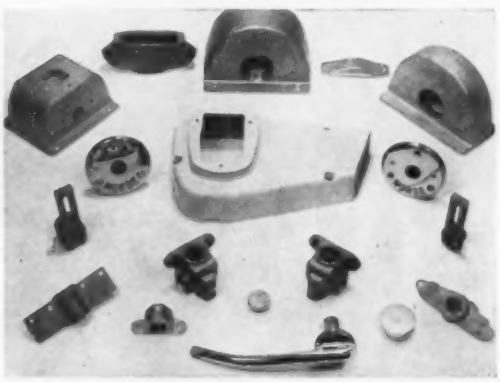
Morse Instrument Company, Hudson, Ohio, manufacturer of marine hardware and control instruments, recently switched from conventional furnaces to TOCCO Induction Melting. Results: greater speed, better working conditions and, above all, purer, sounder castings.

"Castings are free from porosity since we switched to TOCCO Induction Melting," reports president John Morse. "This is a sales advantage to us and a tremendous quality advantage for our customers."

Whether you're interested in melting ferrous or nonferrous metals, TOCCO Induction Melting offers you these important advantages:

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Sample castings produced by Morse Instrument Company with new shell molding process and TOCCO Induction Melting.



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Productivity and Prosperity

Within the past two months, our company research director and I have had the good fortune to see the American Machine Tool Exposition in Chicago, the Production Engineering Show in Chicago and the very large Machine Tool Show at Hannover, Germany.

At Chicago we were impressed with the number of machines equipped with electronic controls and the trend to do more and more to minimize machine downtime and to maximize the production of machines and manpower. Almost every major machine tool manufacturer had one or more tape-control models on display. Several had automatic tool changers designed to further increase output.

We were inclined to be smug about our progress when we arrived at Hannover but, after three days at their fine show, we felt anything but smug! We saw machines with automatic tool changers and tape controls that appear to be considerably advanced over what we are doing in America. Also, the European builders have increased the horsepower of their machines and have beefed up the frames to handle faster, heavier cuts.

When you consider that manpower rates in Europe are from one-quarter to one-third those in America and that the European manufacturers have fine production equipment too, you realize the only way we can protect our jobs and maintain our standard of living is by increasing our manufacturing knowledge and then applying the know-how as quickly as possible. Make no mistake, we are in a race—a race that can only be won by running.

I don't know about you but I'm going to run. I want to maintain and increase my standard of living and that of my family. I hope you do too—enough to make the effort required. ASTME offers you the opportunity to learn. It is up to you to attend the chapter meetings and other educational activities of the Society. You can't learn by staying at home, unless you are reading THE TOOL MANUFACTURING ENGINEER, which I recommend on nights other than chapter meeting nights.

Dale Long

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getting the most

OUT OF MILLING

By Colin Sharp
Director
Cutting Tool Research and Development
Brown & Sharpe Mfg. Co.
Providence, R. I.

Are the milling operations in your plant old-fashioned? The author, a noted authority, shows how modern cutter materials, improved cutter geometries and changes in milling techniques can enable you to "get the most out of milling."

THEORY AND PRACTICE do not always go hand in hand. Using the data available in book form, almost anyone can design a milling cutter and set milling feeds and speeds. Unfortunately, there's often a big difference between planned performance and actual performance. Plants that tool up "by the book" seldom get the most out of milling.

Too Many Teeth? Tooling up for a simple milling job—cutting a 2½-inch-wide piece of SAE 1118 steel to a depth of 3/16-inch—illustrates how theory sometimes breaks down when challenged with shop realities. A 5-hp machine is used. A standard 3-inch diam, 3-inch long plain milling cutter is mounted on a well-supported 1¼inch arbor and the workpiece is rigidly clamped, directly on the machine table, *Fig.* 1.

Theoretically, it should be possible to remove one cubic inch of metal per minute for each machine horsepower. Thus, with this setup, a 5 cubic inch per minute metal-removal rate could be expected, which would call for a feed of 11 ipm. Tests with a 16-tooth cutter showed, however, that at a 4½ ipm feed, severe chatter developed and the cut had to be stopped. At the 4½ ipm feed, only 2 cubic inches of metal per minute could be removed, so the "one cubic inch per horsepower" theory apparently did not work out in practice.

Actually, the theory is generally sound. Most feed-and-speed charts do not take into account the depth of cut, the width of cut and the number of teeth. Usually they suggest a tooth load in a very broad range. Nevertheless, the number of teeth and the width of cut must be considered when calculating the feed and the capacity of the machine.

By changing to an 8-tooth cutter, the differences between theory and practice were reconciled. With this cutter, there was no chatter at 4½ ipm feed, or, for that matter, at 16⅝ ipm feed, the maximum possible on the machine. Stock removal at the higher feed was almost 8 cubic inches per minute with an 0.019 inch feed per tooth.

There is, of course, a limit on the gains that can be realized by reducing the number of teeth. Con-



Fig. 1. This eight-tooth cutter is four times more productive than a sixteen-tooth cutter used with the same machine and setup.

tinuing this test with a four-tooth cutter, tooth loads of 0.025 inch were reached but feeds were reduced to 10⅝ ipm.

This operation demonstrates that the one cubic inch per minute per horsepower metal-removal rate predicted by theory can, in practice, vary from 4/10 to 1 6/10 cubic inch, with the cutter the only variable—showing the importance of cutter selection.

Milling Uphill: With the advent of harder materials, there have been a number of changes in milling practices. Complaints regarding short cutter life are frequently heard, yet, more often than not, the cause is using old-fashioned milling techniques for new materials. Cutter life usually improves when climb milling, rather than conventional milling, is employed. The tougher the material, the greater the need for climb milling.

The advantages of climb milling are two-fold. First, with climb milling, surface finishes are greatly improved—the harder the material, the better the finish. Second, cutter wear is reduced considerably, particularly on hard materials. Climb milling reduces the tendency of most stainless steels and heat-treated alloys to work harden during cutting. In one instance, a change to climb milling when machining a ferro-nickel alloy made it possible to produce 100 pieces per cutter sharpening, as contrasted to the previous 30 pieces. Similarly, after doubling the feed and changing to climb milling when milling heat-treated steel alloy worm gears, production jumped from one piece per sharpening to 80 pieces per sharpening. Climb milling should be employed whenever carbide cutters are used.

Machinability Ratings: Many machinability ratings are based on experiments using a single-point tool. This is, of course, the easiest way to measure cutting loads and wear, but the cutting action of a milling tool is quite different from that of a lathe tool. The nearest approach is in face milling a narrow part where the chip thickness remains almost constant. Even here, there are entry and exit shocks that don't occur in turning. Some materials can be successfully turned but cannot, except at a great sacrifice in cutter life, be milled, machinability ratings notwithstanding. This is particularly true when using carbides to cut high-speed steel. Thus machinability ratings may not be a reliable guide when planning milling operations.

Cutter Geometry: The reduction of the number of teeth in a cutter and the use of better cutter materials and milling techniques have greatly improved productivity. Another significant improvement is revised cutter geometry, particularly the use of larger rake angles.

Many engineers believe that high helix angles reduce cutting loads, thus improving productivity. This belief has gained currency because high helix angles are usually associated with coarse tooth mills. High helix angles do balance out the cutting loads by producing a more uniform cut. The feature that should be credited with raising the volume of material removed per horsepower is increased rake angle. Tests have demonstrated that by changing from the old-fashioned 5-deg rake on end mills to 20 deg, up to 62 percent more material can be removed with the same horsepower, speed, helix angle and number of teeth.

Since high helix angles level off loads, it follows that when a relatively weak cutter—an end mill, for example—is used, faster feeds are possible. From the standpoint of stock removal, experience shows that a helical two-flute mill is the best choice.

It should be added that some accuracy will be sacrificed to gain efficiency. It is almost impossible

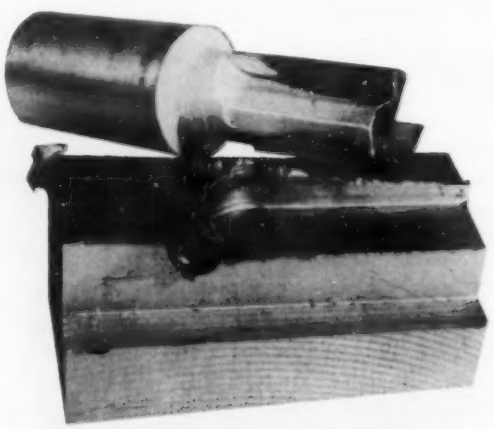


Fig. 2. A carbide end mill gave poor results when attempting to machine the top of this stainless-steel block. Slab milling is preferable.

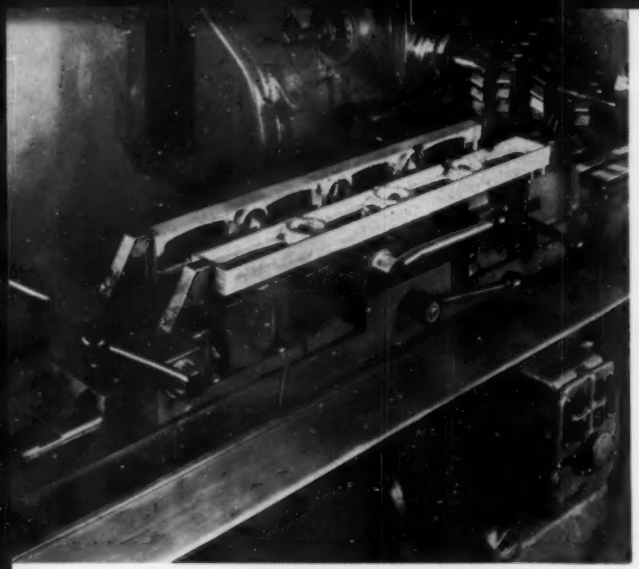


Fig. 3. Setup for milling aluminum carpenter levels.

to produce a parallel and vertical slot with a two-flute mill having helical teeth. One-half-inch-deep cuts made with a ½-inch end mill having a 30-deg helix angle gave unsatisfactory results during a series of tests. The sides of the slot were as much as 0.012 inch from the vertical and the bottom of the cut was about 0.002 inch wider than the top. This was a pull-over of about 1½ deg. By increasing the rake to provide freer cutting action, the pull-over was reduced. Straight flutes, while limiting the feed, do provide parallel and vertical sides in a slot or keyway. On one-cut jobs where it is difficult to hold tolerances with a helical-tooth cutter, making two cuts may help. Using a straight-tooth, two-lip end mill may eliminate the difficulty.

Clearances, or relief angles, are another important factor in cutter performance. Not too many years ago, handbooks recommended that cutters up to 3 inches in diameter be sharpened with a 7-deg relief and cutters over 3 inches in diameter should have a 4-deg relief. Today, recommended relief angles are as high as 25 deg for a 1/16 inch end mill and as low as 4 deg for end mills that are 5 inches in diameter or larger. This relief must, of course, be maintained during resharpening. Too often, milling cutters that worked well when first put into service do not perform well after resharpening. Usually the difficulty can be traced to the failure to provide proper relief.

The Hard Materials: Despite the many advances in milling cutter materials and design, the newer workpiece materials create serious machining problems. Here the type of milling technique used strongly influences production results.

For example, 304 stainless steel was once considered impossible to mill with carbide cutters due to the strong tendency of this material to work harden in the cut. A few years ago, it was discovered that this steel could be face milled with carbide cutters. Recent research shows that slab milling is preferable. A carbide end mill and a block of 304 stainless steel are shown in *Fig.* 2. On the side of the workpiece, several cuts were made with the periphery of a ½-inch end mill cutting ½ inch wide and approximately 0.05 inch deep. A good finish was obtained with no noticeable wear on the cutter. However, when an attempt was made to face mill the top of the workpiece, chips adhered to the carbide tips, causing clogging and overheating that ruined the mill. It was concluded that the chips must be kept cool. Climb slab milling produced cool, colorless chips and good finishes.

The end mill itself was not at fault in these tests. It gave good results as long as its diameter was used as in slab milling.

Incidentally, the best carbides for cutting stainless steel are those designed for cutting cast iron. A spray mist is helpful for controlling chip heat.

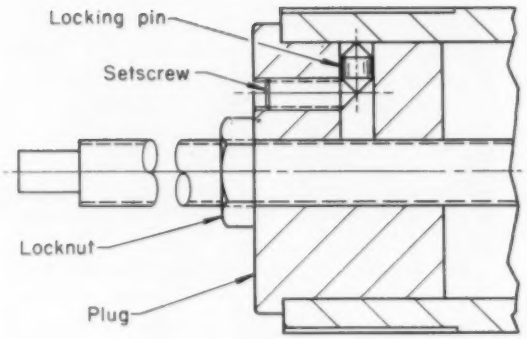
Carbide cutters intended for cutting cast iron are also best for milling the high-temperature stainless materials such as René 41, and high-strength steels such as Vascojet 1000. Tests show that René 41, heat-treated to 40 R_C, can be machined quite well with carbide end mills from ½ inch to 1¼ inches in diameter. The recommended speed is 55 fpm with a chip load of 0.002 inch per tooth. With larger, sturdier cutters, 5-inch-diam side mills for example, speeds to 85 fpm and feeds per tooth up to 0.0035 inch are satisfactory.

The "'super-hard" materials are not the only ones that cause trouble. Recently, a manufacturer was machining some aluminum parts. Cutter life was about one hour. Pure aluminum is extremely machinable, of course, but the aluminum parts in question were sand castings with an extremely high silicon content. When the HSS cutter was replaced with a carbide-tipped cutter, cutter life was two weeks, using the same machine and setup, *Fig.* 3. This illustrates the value of knowing the characteristics of a workpiece material.

Some Rules: There are a few simple rules that serve as a good guide for tooling up for milling:

1. For maximum metal-removal, try using a cutter with fewer teeth.
2. For better cutter life on hard materials, try climb milling. Use mist cooling.
3. For improved output, consider using higher helix and rake angles.
4. For consistent productivity, make sure that the correct reliefs are provided by each sharpening.
5. For best cutter performance, match the cutting tool material to the job. Use carbides for hard, tough and abrasive materials.

Following these rules will enable any plant to get the most out of milling.

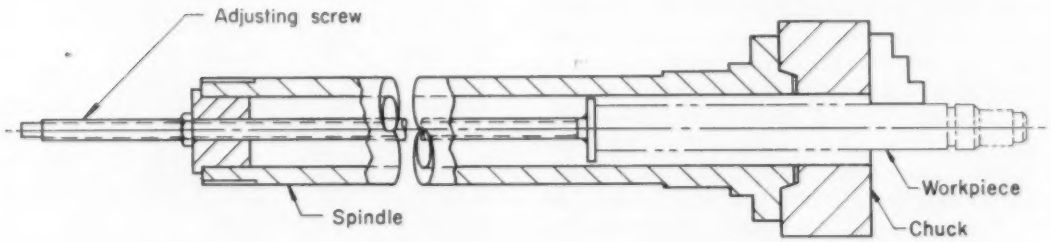


Stop Simplifies Part Positioning

Turret-lathe operations involving comparatively long parts present a problem in workpiece positioning. The device illustrated effectively solves this problem with a stop which can be adjusted to a preselected position. This position is maintained throughout machining by a locknut on the adjusting screw.

The plug holding the adjusting screw is secured by three equally spaced, hardened locking pins. Pointed to a 90 deg included angle at each end, the pins are driven into the spindle and locked by pointed socket-head set screws.

Roger Isetts, Kenosha, Wis.



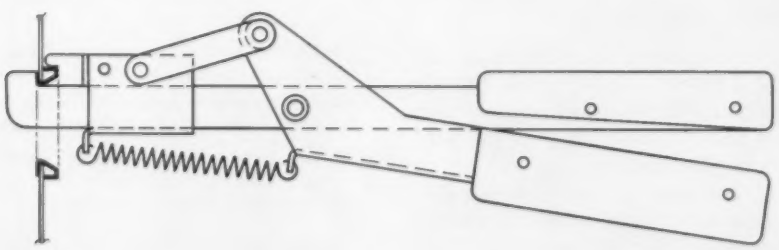
Tool Flanges Internal Tabs

Flanging of internal tabs in assembly operations is often impossible to accomplish by pressworking. A case in point is the coin-return trim on a vending machine. Used as decorative hardware, this component is held in assembly by four tabs, each of which must be manually crimped over the edge of an opening. No marking of the trim's appearance is permissible.

The crimping tool illustrated is an ingenious device which answers the problems posed by such assemblies. Inserted through the opening, the tool utilizes a simple linkage to actuate a movable jaw and crimp the tab. Upon completion of this operation, a spring-return causes the sliding jaw to retract and disengage the tool from the assembly.

*Floyd T. Boosman**
Kansas City Chapter

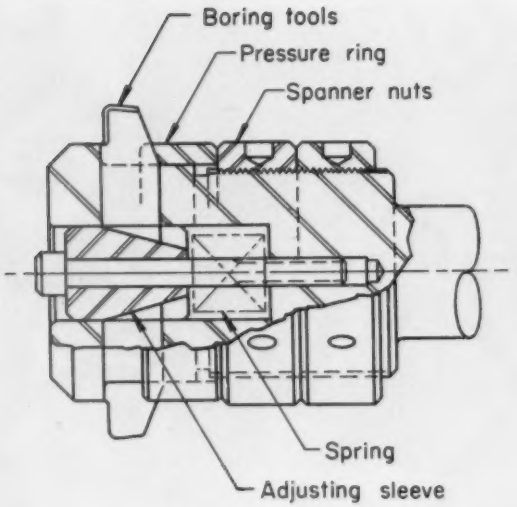
***Gadgets Contest Entry**



Toolholder Is Easily Adjusted

Boring tools are easily and accurately adjusted in this toolholder. Adjustments are made by inward or outward movements of a sleeve in which tapered grooves are machined. After the tool bits are set to required diameters, they are locked in position by a pressure ring backed up by spanner nuts.

Frank Murray
Detroit, Mich.

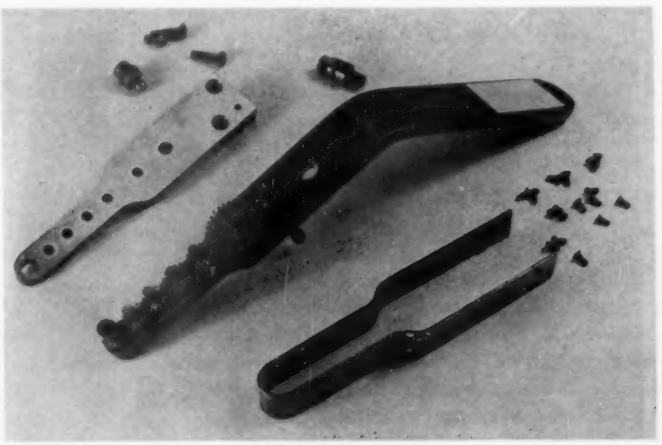


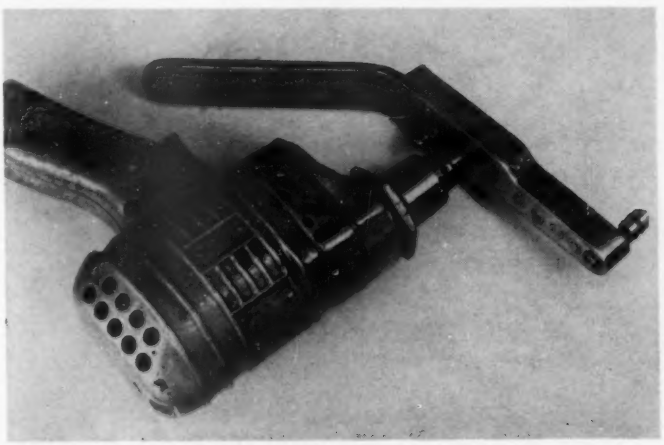
Drill Attachment

The portable drill attachment illustrated is designed for deburring operations inside tubes and other normally inaccessible locations. The device makes use of a train of small spur gears to extend the reach of a small portable drill. A screw shank countersink mounted on the shaft of the final driven gear of the train serves as the cutting tool.

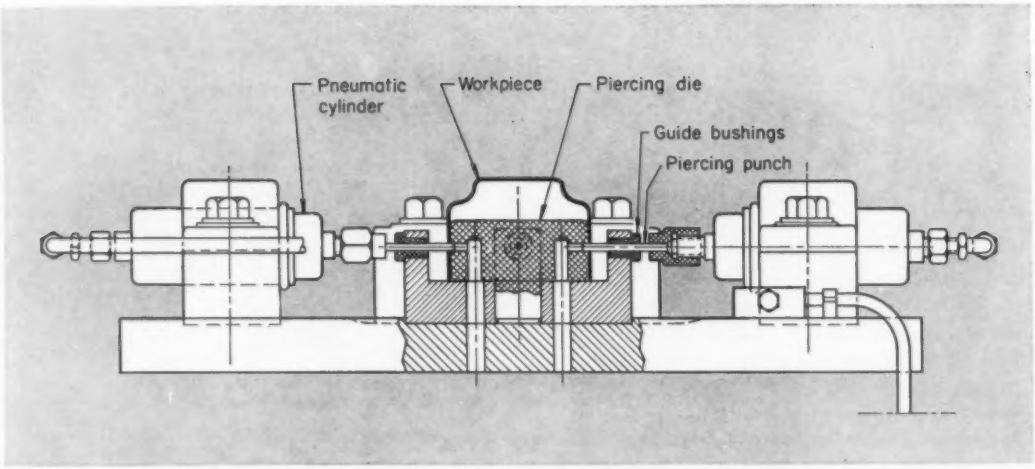
The gears are standard stock items. They are keyed to small shafts which run in bronze bearings. The whole assembly is enclosed with a strip steel cover which protects the gears from chips and dirt. Lubrication for the gears is supplied through a pressure grease fitting on the top of the housing.

H. J. Gerber
Member-at-Large
Stillwater, Okla.





Gadgets



Simple Piercing Fixture Replaces Cam Die

Hole-piercing operations that are usually performed by cam dies can be accomplished in fixtures of the design shown. No press or upper die is required.

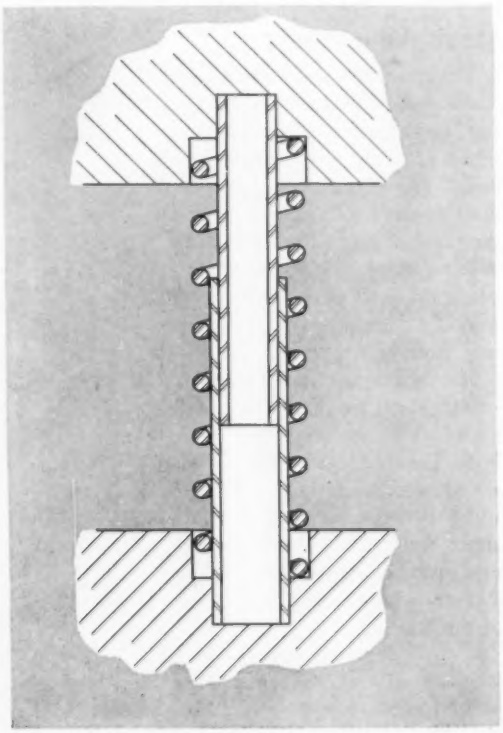
Tools at the piercing stations are similar to conventional pierce-die designs but the punches are driven by pneumatic cylinders instead of cams. In operation these are actuated by a foot valve. After the holes are pierced, compression springs in the cylinders, and air bleedoff, force the pistons to retract and strip the punches.

Hjalmar Dahl, Upplands Vasby, Sweden

Telescoping Guide Holds Springs in Place

Long springs used in open areas of machines and tools tend to buckle and fly out of position when compressed. The telescoping guide illustrated is designed to restrain this radial movement while securing maximum compressive force. In assembly, a press fit is sufficient to hold the tubing.

Federico Strasser
Santiago, Chili



Contributions for these pages describing short cuts for the tool engineer are welcome. Finished drawings are not necessary. Honorariums for accepted articles are sent upon publication.

predicting SURFACE FINISHES

By Robert D. Brown*
Associate Research Engineer
Southwest Research Institute
San Antonio, Texas

Predicting surface finish to high accuracy is possible using equations developed by the author. Or, if speed and ease of solution are more important than extreme accuracy, a graphic method of solution can be used. Only tool radius and feed data are required for solution.

WHEN A ROUND cutting edge is fed uniformly across a workpiece, a scalloped surface, as shown in *Fig.* 1 is produced. Finish of such a machined surface is usually described in terms of either its rms (root-mean-square) or AA (arithmetical average deviation of the surface trace from a mean line that divides the areas on either side of the mean line equally). From F, the feed in ipr, and R, the tool-end radius in inches, surface finish can be predicted accurately using the following equations:

$$\text{rms} = \left\{ R^2 - \frac{F^2}{12} - \frac{1}{F^2}\left[\frac{F}{2}\left(R^2 - \frac{F^2}{4}\right)^{1/2} + R^2 \sin^{-1}\frac{F}{2R} \right]^2 \right\}^{1/2}$$

$$\text{AA} = \frac{2R^2}{F}\sin^{-1}\frac{A}{R} - \frac{2AB}{F}$$

where

$$A = \sqrt{R^2 - B^2}$$

$$B = \sqrt{R^2 - \frac{F}{4}} + \frac{R^2}{F}\sin^{-1}\frac{F}{2R}$$

For ease of use, the equations have been plotted in *Fig.* 2, enabling graphical solution from a given feed and tool radius. For example, using a tool with a 0.125-inch radius, fed at 0.090 ipr, $F/R = 0.720$. Extending this vertically to intersect the AA curve, and then leftward, a value, $\text{AA}/R\ (10^6) = 0.017$ is obtained. Multiplying the right-hand member by the left-hand denominator, AA = 2120 microinches. By intersecting the rms curve in a similar fashion, the finish obtainable from this feed and speed can be predicted as 2380 microinches rms.

*Senior member ASTME St. Louis chapter.

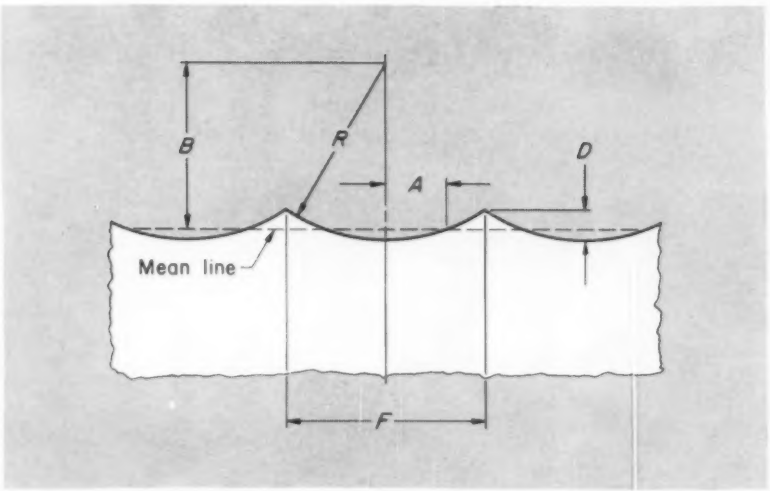


Fig. 1. Geometry and definitions used to describe surface roughness conditions.

Nomenclature

R = tool radius, in.

F = feed per cut, in.

A = distance from the middle of the groove to the intersection of the Mean Line and the surface, in.

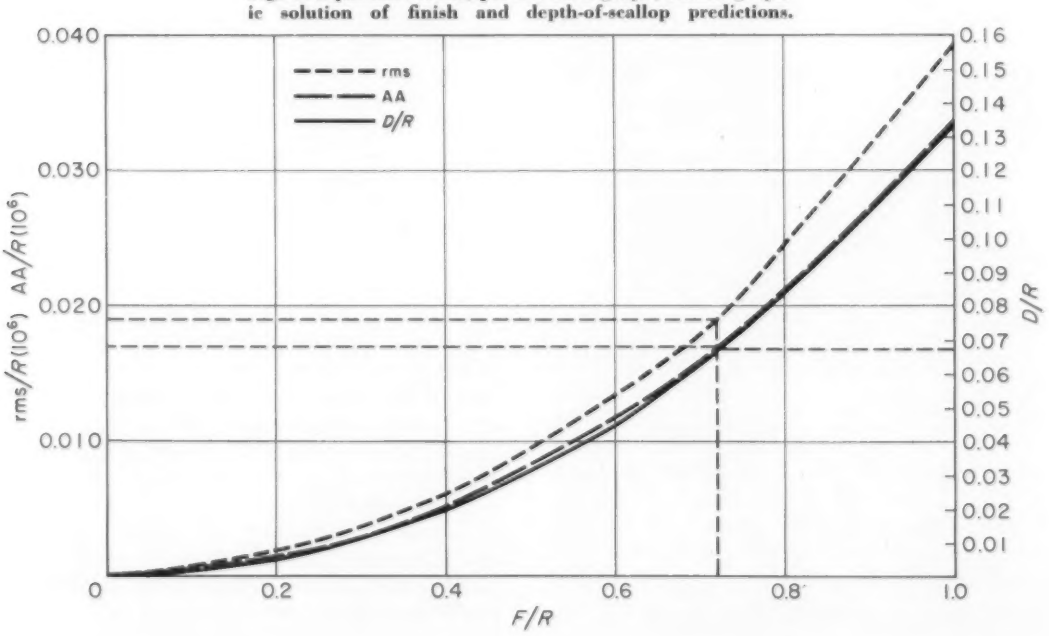
B = distance from the center of tool curvature to the Mean Line, in.

D = depth of scallop, in.

Depth of scallop D is given by the right-hand scale of *Fig.* 2. As shown, the previously obtained F/R value of 0.720 is projected vertically to intersect the D/R curve and projected rightward to obtain the value 0.068 on the D/R scale. Calculating, $D = 0.068\ (0.125) = 0.0085$ inch.

Thus, whether the finish desired is specified by AA or rms, the graphs and equations enable a manufacturing engineer to select an optimum combination of feeds and speeds that will meet finish requirements. These same calculations can be used to produce surfaces suitable for checking roughness measuring equipment. An easily machined metal should be used, to produce smooth cuts.

Fig. 2. Equation results, plotted on a graph, enable graphic solution of finish and depth-of-scallop predictions.





for measuring MILLIONTHS

By George B. Webber
Vice President
Webber Gage Co.
Cleveland, Ohio

Stringent tolerances in Space Age components often exceed the limitations of conventional gage blocks. One good solution to this problem lies in the use of chromium carbide instead of steel as a gage-block material. In this article both materials are discussed.

SINCE THEIR INCEPTION, gage blocks have served industry in two capacities: as measuring tools and as standards of size. In the first capacity, they are useful for reading or establishing dimensions which cannot be determined with standard measuring tools. As standards, *Fig.* 1, they perform their most important function in that they are ultimate arbiters of size.

An example of the use of gage blocks as measuring tools is illustrated in *Fig.* 2. All dimensions in this drill fixture are taken from a ¼-inch diam construction hole. Tolerances are 0.0005 inch. In inspection, the fixture is mounted on a surface plate at a predetermined height. Next, the height of the centerline of the construction hole is determined with a gage block setup. The heights of the other holes are then inspected with additional gage block setups.

Although tolerances are comparatively liberal, gage blocks are the only practical tools available for this type of inspection. Other examples are seen in components which have angular surfaces dimensioned from rools.

The use of gage blocks as standards of size is illustrated in *Fig.* 1. Unlike the drill fixture of *Fig.* 2, dimensions of these parts can be measured with micrometers. However, micrometer inspection is impractical in this instance because of the extremely close tolerances assigned to the dimensions.

Steel Gage Blocks: For years steel gage blocks served this dual role quite adequately, providing accurate measurements into the fourth decimal place. Modern Space Age components have much closer tolerances, however, and conventional steel blocks cannot always be relied upon for accurate inspection. For example, a component can be inspected and approved in one plant but rejected in



Fig. 1. Inspection of a close-tolerance thread gage. Two gage-block setups represent upper and lower limits of tolerances.

another because of minute discrepancies in their respective gage blocks. Each plant can make seemingly valid contentions concerning size but in many cases neither is correct. Dimensional inconsistencies of this type are becoming increasingly common, especially between vendors and users. Although these inconsistencies do not presage a general breakdown of the gage-block system, they do underscore its need for more accurate blocks.

Chromium Carbide: Because gage-block inaccuracies are basically the result of wear, chromium carbide is being used as a substitute for nondeforming steel. Secondary considerations influencing this choice are wringability, corrosion resistance and characteristics of thermal expansion.

In resisting wear, chromium carbide sintered with nickel is highly superior to steel. Depending on usage, gage blocks made of this material provide as



Fig. 2. Checking hole locations in a drill fixture. Each setup represents a hole location.



Fig. 3. Setting an optical comparator with gage blocks. Comparator is set at mean dimension and size deviations are read on comparator scale.

much as 30 to 70 times more service between calibrations than steel. Because of this increased wear resistance replacement costs are reduced. These economies are often sufficient to overcome the higher initial cost of chromium-carbide gage blocks.

Wringability is also an important consideration, especially when multiple gage-block setups are made. Essentially this characteristic refers to the ability of gage blocks to be pressed together without an intervening cushion of air. For example in *Fig.* 3 a buildup of three blocks is used to set an optical comparator. If the blocks are steel and are calibrated +2, +4 and +6 microinches over nominal sizes, the error in this buildup will theoretically be +12 microinches. In practice, however, steel blocks will have an accumulation closer to +20 than +12 microinches. The larger accumulation of error is a direct result of imperfect wringability. If a similar buildup is made of chromium-carbide blocks, accumulated error will be no more than 3 microinches.

Improved wringability is a result of the smoother finishes possible in chromium carbide. This, in turn, results from the material's finer grain structure—the key to mirror finishes. Normally, surface finishes of 0.1 to 0.3 microinch can be obtained in chromium-carbide gage blocks.

A block's ability to resist corrosion is also important in maintaining calibrated sizes. Because steel blocks are not impervious to body acids, fingerprints are easily etched into their surfaces. These and other marks resulting from corrosion decrease accuracy and impair wringability in individual blocks. Chromium carbide again shows an advantage over steel by its resistance to the corrosive effects of ordinary acids, cutting oils and moisture. Its resistance to acid is approximately 30 times that of 18-8 stainless steel.

The final variable, thermal expansion, is critical since inspection is not always made in temperature-controlled rooms. Because chromium carbide's coefficient of expansion differs only minutely from that of steel, normal temperature variations have little effect on size. Any temperature-induced expansion or contraction in the workpiece is compensated for by a similar change in the gage blocks.

Although few plants, as yet, have entirely discarded their steel blocks, many are making a gradual transition to chromium carbide. This is accomplished by block-for-block replacement when individual steel blocks show excessive wear. As the number of companies engaged in close tolerance work increases, it is inevitable that steel gage blocks will pass from the industrial scene.

computer takes over

—for product design and manufacturing

By Robert Heslen, Associate Editor

Starting from performance requirements, torque converter shapes are defined by a computer program. Results of this program are fed into another computer program that produces a tape for numerically controlled machining of the workpiece. Accuracy is improved and lead time is cut in half.

BY THE USE of numerical control, engineers at the Buick Motor Div. of GM have shortened the gap in time between design and manufacture. Each product cycle requires design, prototype manufacture and prototype test. Testing often reveals that design changes can improve the product, and start another design cycle. A long design cycle thus hinders product development. Compressing the design cycle gives both design and manufacturing engineers greater opportunity to employ their creative ability for product and process improvement.

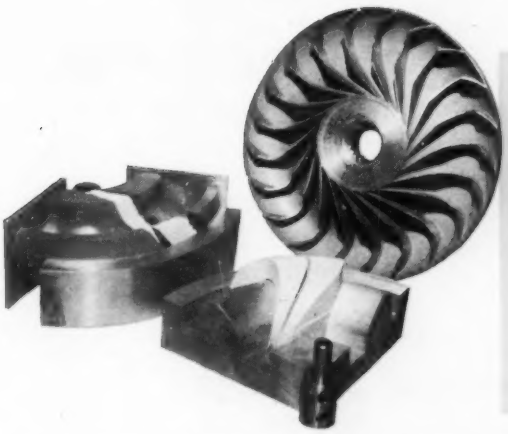
Original Method: The variable in torque converter design is the converter vane contours since the exterior dimensions of the converter package are relatively constant. In casting a prototype, cores are required to form the correct size and shape of the desired flow passage, as shown in *Fig.* 1. Originally, master cores were hand cut to make the desired vane contour for the torque converter. To make the master, station lines were scribed on the inner and outer surfaces of the torus ring and the desired contour indicated by points scribed on these station lines. The material was then cut away until a surface resulted that contained the points on the inside and outside surfaces of the torus, the points being connected by straight lines. From the master a plastic core was made as shown in *Fig.* 2. When the matching sections of the torus are assembled in the core box, the unfilled space represents the core shape. From a set of cores the prototype is cast. Any variation in prototype design required a repeat of these operations. When designs were frozen for the production model, the entire process was repeated with greater accuracy to make the production tooling. Time required for this design cycle limited the amount of development possible.

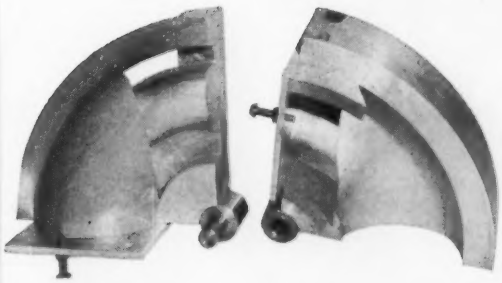
Later developments required a vane contour not limited to straight line sections. Since many more data points are required to define a curved piece than a straight-line piece, Buick engineers turned to a computer for handling this design problem. An IBM 705 program was developed to take a set of desired vane specifications, test their properties and develop a vane contour approximating the original design criteria. The program also developed a graph of the vane profile. About fifty data points define the profile in one plane.

From the vane profile, a template was made for use on a tracer controlled machine. The desired surface was developed as shown in *Fig.* 3. This method required hours of careful machining by a skilled machinist, but provided a more accurate surface requiring less hand finishing than the previous method of scribing on the torus ring. Time required to develop these surfaces averaged six days compared to nine days for the original method. The time reduction was accomplished even though a more complex surface was involved.

Numerical Control Manufacture: As a complex surface is involved, it was recognized that tape controlled milling offered many possibilities for improving the manufacture of the cores. A joint effort was made using the experience and facilities of GM Research Laboratories computing section for tape preparation and of the contract machining department of Bendix Industrial Controls for the tape controlled milling.

The program was written in Fortran, a powerful pseudocode that simplifies computor programming for an IBM 704 computer. Some of the subroutines of APT numerical control program are used. Input





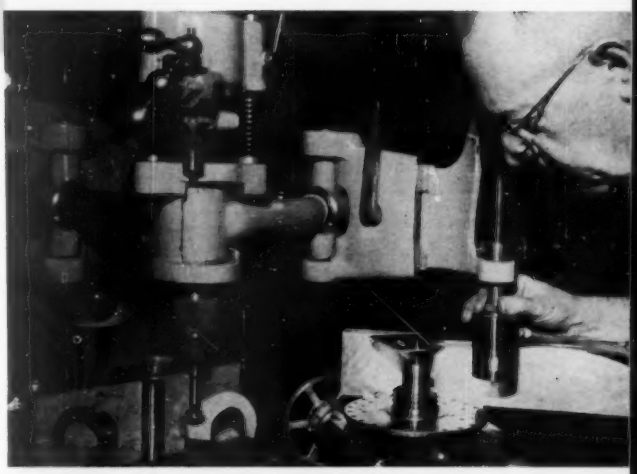


Fig. 1. (above) Torque converter prototypes are designed using computers and manufactured using numerical control.

Fig. 2. (upper right) Matching faces of the epoxy toroid are machined under numerical control.

Fig. 3 (right) Lead time was reduced and accuracy gained by eliminating template manufacture.

is the set of data points defining the vane profile obtained from the IBM 705 program. From the original fifty points, the IBM 704 program develops over seven thousand coordinate points to define the surface to be cut. The program interpolates additional points between those given by the IBM 705 program using fine increments to produce a relatively smooth curve lying in the *XY* plane. The program then increments 0.025 inch in the *Z* direction to another *XY* plane parallel to the first *XY* plane. The vane profile is again interpolated to produce a smooth curve in an *XY* plane. This process is completed by finding a succession of *XY* curves lying in planes parallel and 0.025 inch distant, until the entire surface is defined.

The program at this point has developed a three-dimensional contour representing the mean centerline of the vane. Given the number of vanes and draft required, the computer determines thickness. Cutter radius and core kiss face areas (the areas of zero wall thickness where the vane cores touch) are also given to the computer. From this, a new set of X, Y, Z coordinates are computed to define the path the tool center must follow for the tool's cutting edge to generate the vane surface.

These tool center coordinates are used as input to a post processor subroutine along with feed rate and tolerance information to produce an output in language used by the control system. Cutter center paths are developed for both matching faces of the toroidal core box inserts. The IBM 704 output on magnetic tape is converted to punched mylar tape, the input tape used by the Bendix control system. From the start, using input data developed by the 705, to the finish, magnetic tape output for two faces, requires about 25 minutes.

For machining, the aluminum-filled epoxy toroid is mounted on the milling machine, tape loaded, and the epoxy toroid core box insert machined to make one face. The same setup is used to machine the second face after inserting a new piece of epoxy in the fixture. Taped instructions for machining the second face follow the instructions for machining the first face so that it is not necessary to reload tape. Machining time is about 18 minutes per face.

The numerical control method of making core box inserts is approximately twice as fast as the original method. Without transportation delay, (the three plants involved are located in different cities), it could be done in one day instead of four. Greater accuracy is obtained so that the experimental model is accurate enough to be used as a direct pattern for production tooling, thus shortening the production lead time. By changing program input to run new contours minor variations in curvature and torus shapes can be made with no design engineer time required. Ability to design and manufacture prototypes this fast means more time for improvements before the production deadline.

Acknowledgement

In the preparation of this article, much assistance was provided by Frank Walker and John Fisher of Buick Motor Div., and D. R. Clanahan of Bendix Industrial Controls Div. of The Bendix Corp.

designed for

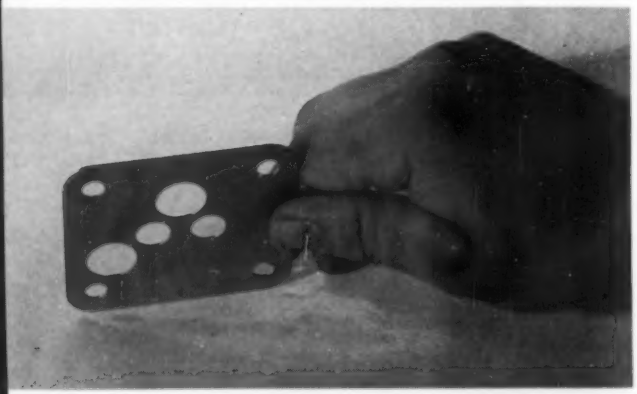
PRODUCTION

Die Produces Square-Edged Stampings

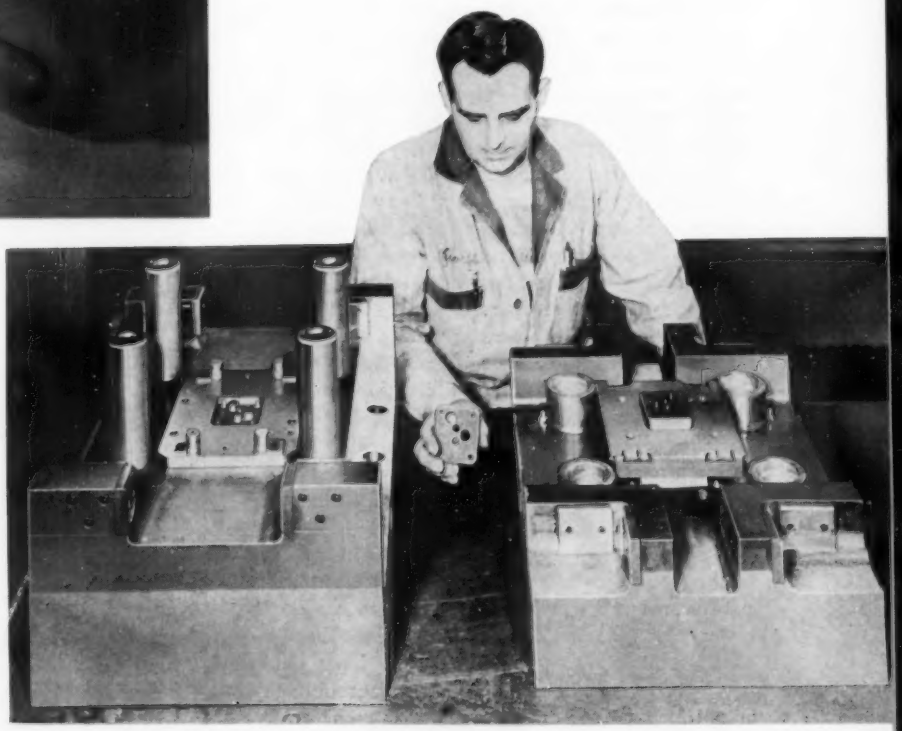
Perfectly square edges showing a high degree of surface finish characterize stampings produced in this die. In conventional blanking operations square edges are impossible to obtain since blanks must taper an amount equivalent to the die clearance. Normally this is 10 percent of metal thickness. In cases where perfect edges are required from conventional designs, shaving dies involving secondary press operations must be utilized.

In this press tool, a product of Hydro-Cam Engineering Co., Troy, Mich., square blank edges are produced by extremely high pressures on the stock and a metal-to-metal fit in punch and die. Pressure on the stock is exerted by a specially designed stockholder which also functions as a stripper plate. This combination—little or no clearance and high pressure—restricts metal flow within the sheet, entirely eliminating the tearing action of conventional dies.

An additional benefit of this design is that the die is not restricted to stock of any specific thickness. Unlike a conventional blanking die, it will accept stock of virtually any size and analysis.



PART produced in die. Hole edges also show high finish.



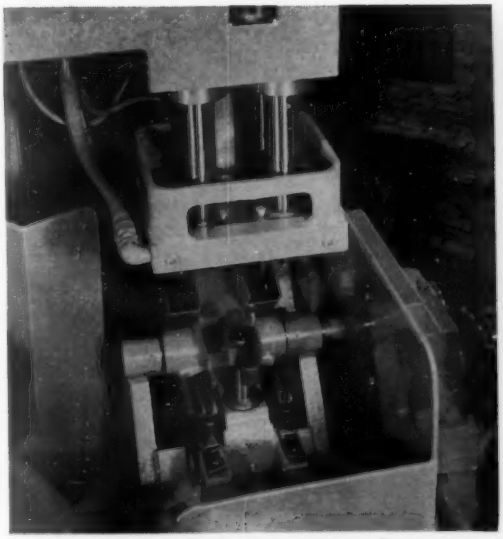
BLANKING DIE opened for inspection. Stamped parts require comparatively heavy dies which can withstand plate and blanking pressures.

Index Machine Has Off-Dial Station

Designed to mill, drill and spot face two different sizes of bearing caps, this machine departs from conventional design in that it incorporates an off-dial station. The machine is built by Cross Co., Detroit, Mich.

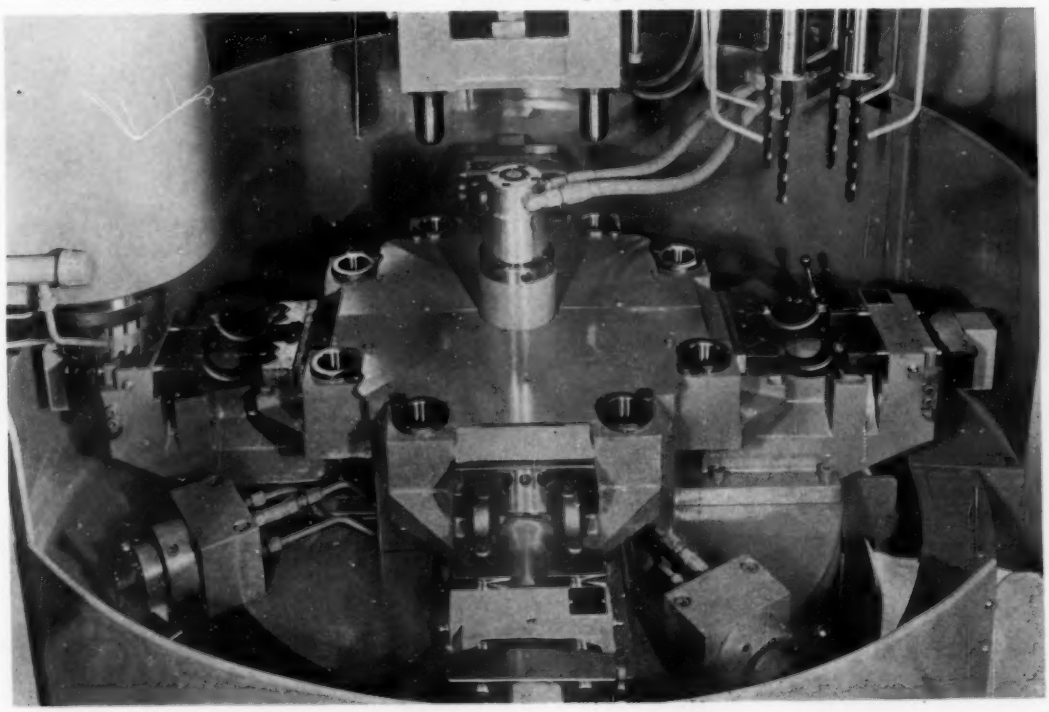
In operation, rough parts are loaded and indexed to the first station where bearing faces are milled by a standard horizontal hydraulic feed unit. At the remaining dial stations drilling operations are performed by a special head mounted on a vertical feed unit. This unit also carries the spotfacers for machining in the off-dial station.

Loading in the off-dial station is performed manually. After drilling and spotfacing have been completed, the vertical head retracts, initiating the index cycle. Simultaneously, unloading arms are activated for finished part removal.

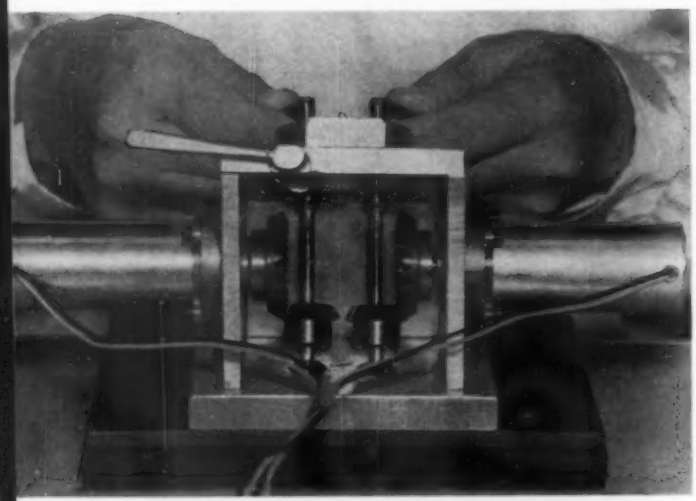


OFF-DIAL station with finished part in place. Normally parts are ejected at completion of spotfacing.

FOUR-STATION table of indexing machine. Hydraulic clamping of parts is automatic at start of cycle.



Electrical Drive Controls Nut Tightness

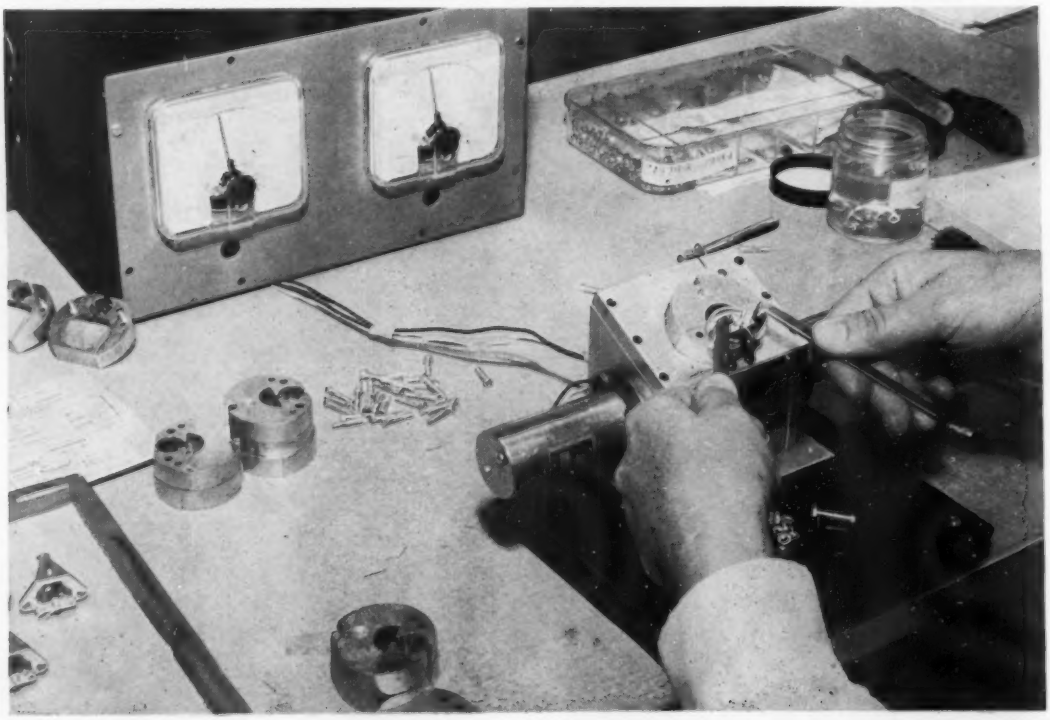


TWO UNITS are assembled simultaneously. Tubes at side contain 0.002-hp motors.

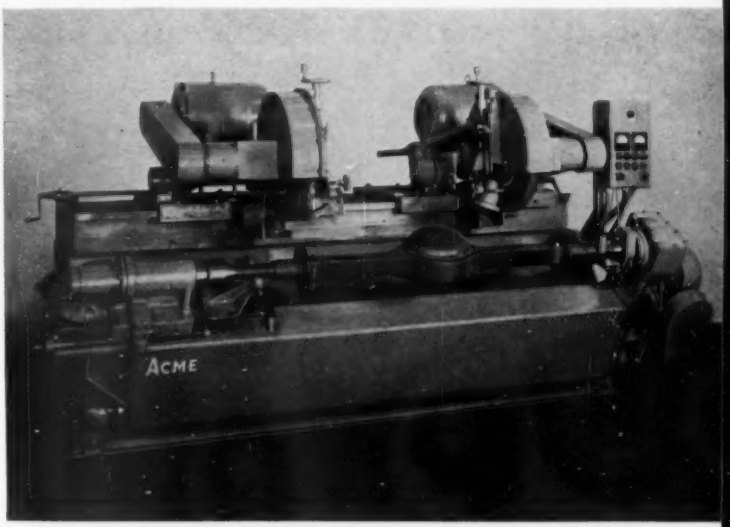
Control of fastener tightness—an important variable in the manufacture of electrical components—is maintained to close tolerances by the fixture illustrated. No slip clutch is used and repeatability is accurate to within a fraction of one percent.

Built by Assembly Products, Inc., Chesterland, Ohio, for use in its assembly operations, the fixture obtains constant torque by equating electrical current to fastener tightness. When the current at the motor reaches a prescribed level, a relay automatically stops the motor. Because torque requirements vary between different fasteners, shut-off relays can be energized for any preselected current.

ASSEMBLY FIXTURE in operation. Motor-relays (left background) stop motors when current reaches preselected level.



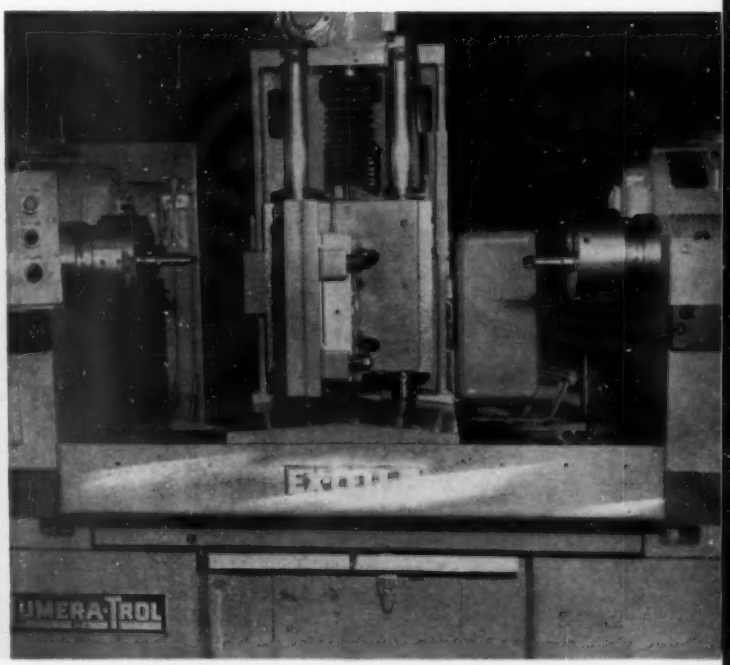
Cylindrical Type Grinder Finishes Flat Surfaces



Weld flash on flat and noncylindrical surfaces is ground on this rotating axle-housing grinder, a development of Acme Manufacturing Co., Detroit. Grinding is accomplished by two adjustable heads mounted on a reciprocating slide. Purpose of reciprocation is to insure uniform grinding-wheel wear.

In operation the workpiece is mounted between centers on a pivoting assembly. Rotating on an axis at its lower extremity, the entire assembly swings up to contact the grinding wheels. The workpiece, driven by a motor at one center, is then rotated beneath the wheels which utilize a floating cam action to follow the welded surfaces.

Boring Unit Programs Hole Location and Size



Using a new concept of numerical control, the Ex-Cell-O boring machine illustrated accepts taped commands to control the radius of tool rotation. Changes in radius are made by a special tool-control mechanism which moves the bar in increments of 0.0001 inch.

In this application boring is performed simultaneously from both ends of the machine, making it possible to bore and counterbore in one setup. To eliminate tool withdrawal marks, the holes are programmed in descending order from the largest to the smallest diameters. When boring heads reach prescribed depths, the control mechanism immediately reduces diameter and the head retracts.

High-Temperature Machining solves space-age metalcutting problems

By William Pentland, Research Supervisor
Jens L. Wennberg*, Senior Research Engineer
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When hard materials are machined at high temperatures, both tool forces and the amount of work done in cutting are reduced. Machining efficiency rises and tools last as much as 40 times longer. This article and the two following articles are based on papers to be presented at the ASTME Western Engineering Conference, Los Angeles, Nov. 14-18.

WITH THE ADVENT of the Space Age, it has become necessary to machine extremely hard materials in large quantities. Many of these materials cannot be machined efficiently by conventional methods. Feeds and speeds must be reduced greatly to obtain reasonable tool life and, even when tools stand up during cutting at higher feeds and speeds, cutting forces may exceed machine capacity.

One solution to this problem is heating of the workpiece. It has long been known that heating, by reducing work material strength, improves machinability. Recent research performed under Air Force sponsorship by The Cincinnati Milling Machine Co. has demonstrated that the theoretical benefits of elevated-temperature machining can be realized on a practical production basis.

The objectives of the research program were three fold: (1) to examine the influence of elevated temperatures on the basic machining parameters and, at the same time, to determine the effects of heat on the machinability of high-strength alloys; (2) to investigate and develop controlled heating methods suitable for application in machining operations; and (3) to measure the effects of elevated-temperature machining on the metallurgy and geometry of the workpiece. During the course of the research program, orthogonal and conventional turning, milling, and drilling were investigated.

Four different work materials were tested. These were a low-alloy martensitic steel, AISI 4340; a hot-work die steel, Thermold J; and two precipitation-hardening stainless steels, 17-7 PH and 17-4 MO. Each material was subjected to two different heat-treatment procedures and specimens were obtained over a range of hardness from 350 to 600 Bhn.

Orthogonal Turning: During orthogonal turning tests, such quantities as tool forces, ratio of feed per revolution to chip thickness and tool geometry were measured. Other fundamental quantities—shear plane angle, mean coefficient of friction between tool and chip, and energy distributions—were derived using the Merchant theory. Measurements were also made of workpiece temperature and mean temperature at the chip-tool interface to obtain the correlation of these factors to the other basic parameters.

The equipment used for orthogonal turning is shown in *Fig.* 1. It consists of a horizontal milling

*ASTME member-at-large.

From Paper No. 307 "Researches in Elevated Temperature Maching Of High Strength Materials" to be presented at the ASTME 28th Semiannual Meeting. Copies of the complete paper, which contains a full bibliography, can be purchased from Society Headquarters.

machine with a chuck holding a 2⅛-inch diam tubular workpiece having a 0.250-inch wall thickness. Since the toolpost was held on the machine table, the arrangement was essentially orthogonal turning with only a two-dimensional force system involved.

The tool itself was held in a force dynamometer. A multitip, water-cooled burner, fueled by oxygen and propane gas, was used to heat the workpiece. Workpiece temperature was measured by shutting off the gas flow to the burner and using a contact pyrometer on the end of the tube.

The mean temperature of the interface between tool, chip and workpiece was measured by using this interface as the hot junction of a thermocouple circuit where the thermoelectric members were the sintered carbide tool material and the steel workpiece.

Several hundred test cuts were made, using four work materials, each with two heat treatments, and two tool materials. All cuts were taken at 250 fpm cutting speed and 0.0048 ipr feed.

Turning Results: Results of the tests, *Fig.* 2, showed that a 1000 F rise in workpiece temperature gives reductions of 40 to 50 percent in cutting force and reductions of 33 to 66 percent in thrust force at the tool. There was little difference in tool forces between the 400 Bhn and 600 Bhn workpieces when heated—their elevated-temperature strengths are much closer than their strengths at room temperature.

Raising the workpiece temperature has different effects on mean tool-chip interface temperatures for different workpiece materials. Thus a rise in workpiece temperature of 1000 deg F raised the tool temperature by 250-350 deg for Thermold J, by 700-1000 deg for AISI 4340, by 300-700 deg for 17-7 PH and by 600-1100 deg for 17-4 MO.

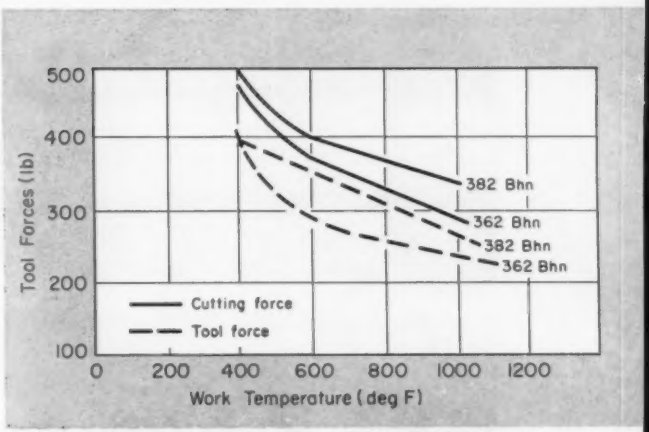


Fig. 2. Effect of workpiece temperature on tool force and cutting force for 17-4 MO steel, cut with Grade 350 carbide in orthogonal turning tests.

Friction between the workpiece and tool may remain constant, or may either decrease or increase in hot machining, depending on the tool-workpiece pair. With Thermold J die steel and 17-4 MO stainless steel, the mean coefficient of friction remains constant when the workpiece temperature is increased 1000 deg. However, with other steels increases or decreases are obtained.

The fundamental idea behind elevated-temperature machining is that at higher workpiece temperatures the shear strength of the material is reduced. Chip formation by plastic deformation due to shear on the plane ahead of the tool becomes easier. That this is so was demonstrated during the tests. Calculated reductions of mean shear stress on the plane of shear were from 40 to 60 percent with workpiece temperatures increased 1000 deg. These stresses can be taken as the apparent shear strength of the

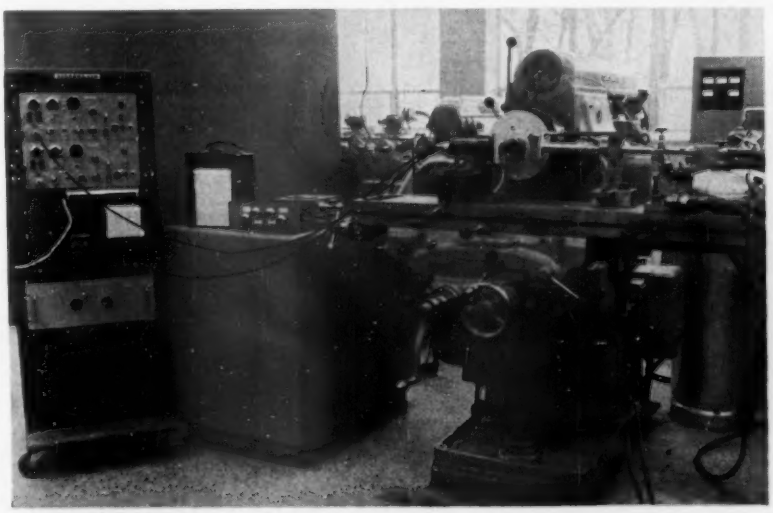


Fig. 1. Orthogonal turning apparatus. Workpiece is flame-heated. Tool forces and tool temperatures are recorded on charts.

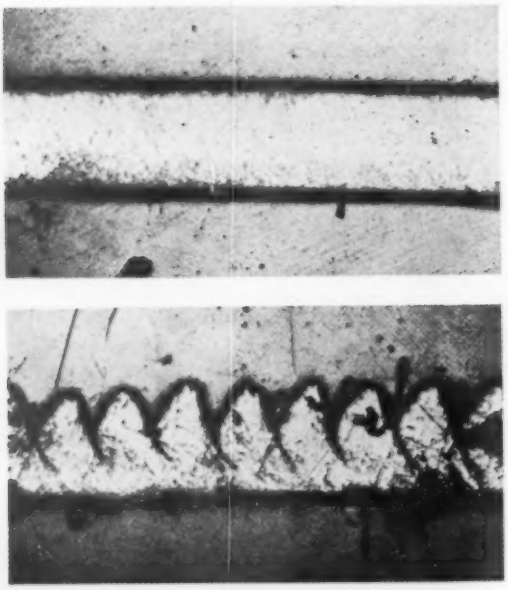


Fig. 3. Effect of workpiece temperature on chip formation. Chip at top was formed at 1500 F; chip at bottom was formed at 300 F.

material, since shearing is taking place.

Plastic deformation in cutting is assisted by elevating the workpiece temperature. This is illustrated by *Fig.* 3, which shows photographs of cross sections of chips taken across their length. At 1500 F, the chip is formed by a steady plastic flow of the work material. At 300 F, the chip is almost segmented and is formed with a series of discontinuities along its length through half the chip thickness.

Defining the efficiency of metal-removal as the cubic inches removed for cutting horsepower-minutes, it is evident from *Fig.* 4 that efficiency is increased by 40 to 50 percent when cutting 390 Bhn AISI 4340 steel at elevated temperatures. The heating power is not included in this expression. The amount of work done in chip formation is similarly reduced 30 to 50 percent by elevating the temperature of a 390 Bhn Thermold J workpiece 1000 F, as shown in *Fig.* 5.

Turning Tool Life: Cutting-speed tool life relationships were obtained through a series of tests using a 21½-inch Cincinnati "Traytop" machine. Induction and radio-frequency resistance heating were used to elevate the workpiece temperature. Power for this purpose was provided by a 30 kw Inductron unit, operating at 1.2 megacycles per second.

In induction heating, *Fig.* 6, the coil was mounted on the lathe carriage and traveled with it during cutting, heating the workpiece just ahead of the cutting tool. A radiometer, focused on an area of the workpiece just above the tool indicated the temperature of the workpiece as it entered the cut.

"Throwaway" carbide tools, Grade 350, were used in the induction-heated tests and the tool life criterion was taken as 0.015-inch flank wear as measured on a toolmaker's microscope. Tool flank wear measurements were taken every two minutes.

The cutting tool geometry was as follows: side and back rakes, 5 deg negative; side cutting edge angle, 15 deg; nose radius, $\frac{1}{32}$ inch; and clearance angles, 5 deg.

In the radio-frequency resistance heated tests, *Fig.* 7, triangular cemented oxide tips, Grade 0-30, were used. The tool geometry was the same as for the carbide tools, except for a zero deg side cutting edge angle. These tests were confined to 600 Bhn Thermold J.

The tool life improvements that were obtained at elevated temperatures were spectacular. When turning 600 Bhn AISI 4340 steel at 170 fpm cutting speed, *Fig.* 8, a 20-fold increase in tool life was obtained by raising the workpiece temperature from

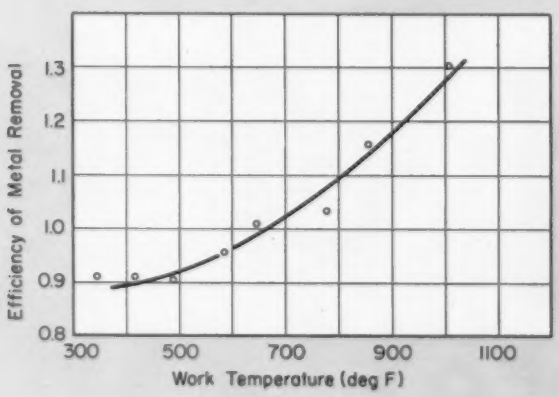


Fig. 4. Efficiency of metal-removal at various work temperatures when turning 390 Bhn AISI 4340 steel.

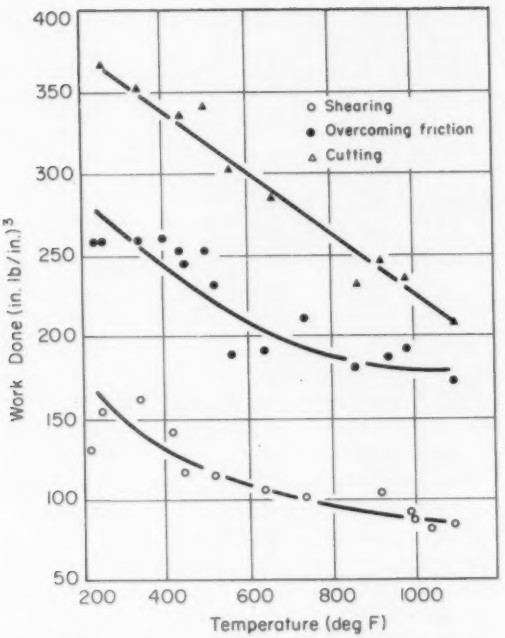


Fig. 5. Effect of workpiece temperature on the amount of work done when cutting Thermold J die steel.

room temperature to 900 F. For 400 Bhn 17-4 MO, a five-fold increase in tool life was obtained by going from 76 F to 900 F. Cutting speed was 450 fpm.

Using Grade 0-30 ceramic tools to cut 600 Bhn Thermold J, a tool life of 30 seconds was obtained when cutting at room temperature with a 500 fpm speed. Tool life increased to 11 minutes at 450 F, to 15 minutes at 600 F and to 20 minutes at 800 F—a 40-fold increase.

Surface finishes were excellent in all tests, though some oxidation (to the extent of discoloration) was encountered at the elevated temperatures used. Long straight chips were obtained and these did not respond to normal chip breaking techniques.

Milling Tests: The machine used for elevated-temperature milling tests was a Cincinnati No. 4 vertical "Dual Power" milling machine. Heat was supplied by a 1.2 megacycles per second frequency, 30 kw induction heating unit.

In the induction heating setup, the workpiece was set with about ⅛-inch air gap between it and a pancake coil and fed along underneath the coil. Soon after the workpiece emerged from under the coil, a single-tooth carbide face milling cutter milled off the top layer of material. The amount of induced heat was controlled by varying the gap between coil and workpiece and by altering the eight power input settings available at the induction heating unit. Temperatures at the workpiece surface of up to 1350 F (for AISI 4340) were obtained in the tests.

The tool-work thermocouple was similar to that used in the orthogonal turning tests. To measure tool forces, a high stiffness three-axis milling dynamometer was constructed.

The workpieces used in the face milling tests were 1-inch wide, 12-inches long and 5-inches deep. Grade 370 carbide cutters were used with axial and radial rakes of minus 5 deg, 15 deg corner angle and 1/16 inch nose radius. Flank wear of the tool amounting to 0.030 inch was taken as the tool life criterion.

Some typical tool life-cutting speed curves are shown in *Fig.* 9. When face milling 380 Bhn 17-4 MO stainless steel at room temperature, tool life was less than one-half minute in the cutting speed range used. Tool life increased to 20 minutes at 400 F and was up to 50 minutes at 1000 F. This was a 100-fold increase. Tool life when machining this hard material at 1000 F was approximately equivalent to that obtained when machining a soft C1018 steel at room temperature. Similarly, tool life was improved 20-fold by elevating the temperature of 390 Bhn Thermold J from 73 F to 1000 F.

Two quantities were found to have influence on the length of tool life during the milling tests. The first of these was the angle of engagement between tool and workpiece as the cutter entered the cut during each revolution. This angle is dependent on the distance between the workpiece face and the cutter axis, and on the cutter diameter.

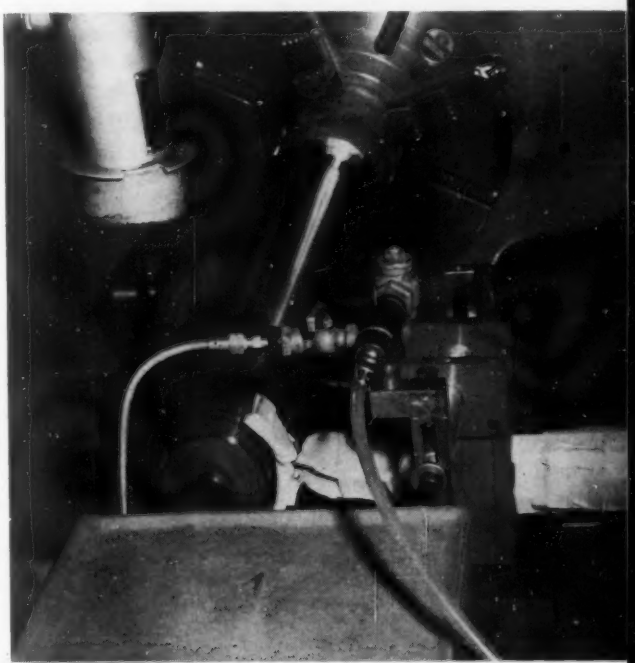


Fig. 6. Induction-heated turning apparatus. A water-cooled heating coil is used. A radiometer measures temperatures. Coil travels with carriage.

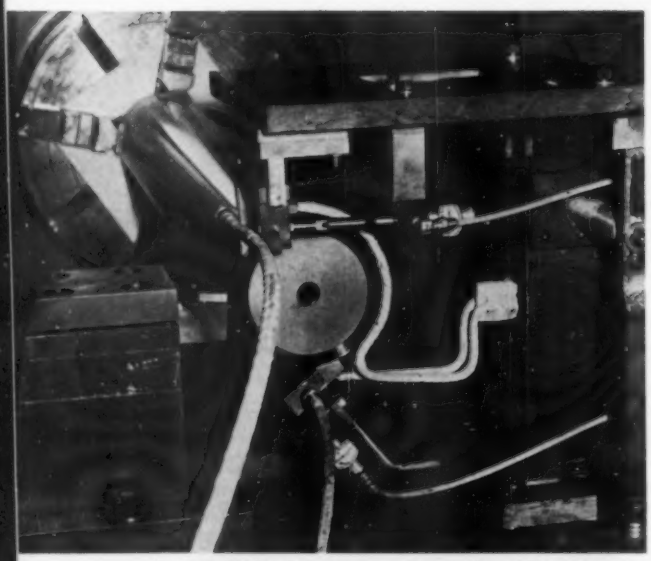


Fig. 7. Radio-frequency resistance-heated turning apparatus. Heat is concentrated.

The second factor that was found to influence cutter life considerably was the presence of asbestos at the engagement side of the workpiece. By placing a $\frac{3}{8}$-inch thickness of crysotile asbestos at the entry to the cut, it was found that tool life could be greatly prolonged under certain cutting conditions. It is thought that three effects contribute to this phenomenon: (1) a thermal effect due to the insulation protection afforded by the asbestos, which raised the engagement surface temperature about 10 percent; (2) a possible chemical effect; and (3) a dynamic effect in which the asbestos damped the severity of the impact of the cutter on the workpiece during the intermittent cut.

There were indications during the tests that the limiting factor in the elevation of workpiece temperature is reached when welding occurs between chip and tool. This temperature was found to be around 1100 F, depending on cutting conditions.

Refractory materials—tantalum, tungsten, beta-titanium, molybdenum and an alloy of 60 percent tungsten with 40 percent molybdenum—were also tested. While no tool-life comparisons were obtained, these materials perform in similar fashion to the high-strength alloy steels tested, with respect to tool forces and temperatures, and it is reasonable to assume that tool life improvements would result from elevation of the workpiece temperature.

Drilling Tests: Tests with high-speed steel and cobalt high-speed steel drills were conducted on a 21-inch drill press. Since the drill press used for these tests had a limited feed range, tests with carbide-tipped die drills and solid carbide drills were conducted on a No. 5 vertical milling machine. A drilling dynamometer was installed to measure the torque and thrust force.

Increase in thrust force was the criterion used to determine tool life. The drill was considered to have failed when the thrust force increased sharply. Through-heating of the workpiece prior to machining was provided by a thermostatically controlled 3000-watt electric furnace.

High-speed steel drills of $\frac{1}{4}$-inch diam were tested on a block of AISI 4340 steel (535 Bhn) with minuscule tool life at room temperature, cutting at 25 fpm. When a feed of 0.005 ipr was used, drill failure was by fracture. A very slight improvement in drill life was obtained when the block was heated to 300 F but the tool life dropped off sharply above this temperature. It was felt that hot drilling would be more successful with less heat-sensitive tools.

Using the same type of drill, 17-4 MO was drilled with somewhat better success. It appears that the optimum workpiece temperature is about 300 F to 350 F and that approximately three times as many holes can be drilled at this temperature as at room temperature before drill failure.

Cobalt high-speed steel drills gave an increase in drill life over regular high-speed steel drills at room temperature and at 300 F, but the improvement was not great enough to warrant further study.

Carbide-tipped drills of $\frac{9}{16}$-inch diam gave greatly improved tool life for holes shorter than the length of carbide tip. When deeper holes were drilled, the drill shank was fractured at the base of the carbide insert due to restrictions in chip flow.

When $\frac{1}{2}$-inch diam solid carbide drills with conventional geometry were used at elevated temperatures, binding and pickup on the margins was experienced. To combat these shortcomings, the margin was ground with a 5-deg clearance (in place of the usual circle grind) for $\frac{1}{4}$ inch from the end of the cutting lip and a back taper of 0.002 inch per inch was ground from the end of the clearance face up the rest of the drill. These modifications prevented the surface of the block from shrinking onto the drill when it cooled and provided a cutting edge to cut the slightly smaller surface hole when the drill was retracted. Since most of the failures were due to chipping of the primary cutting edges, a primary zero-deg axial rake face was ground on the cutting edge in place of the normally positive axial rake. This, combined with the actual negative radial rake, gave a negative normal rake and less chipping.

Tool life-cutting speed tests at various temperatures using Grade C-2 solid carbide drills cutting AISI 4340 steel (510 Bhn) showed no improvement in drill life at any elevated temperature.

Heating Methods: Selection of heating techniques for hot machining is based on the type of operation and the sensitivity of the workpiece to

thermal damage. The ideal heating method would heat only the shear zone, where chip formation occurs. The finished material would not be heated, and adverse thermal effects such as tempering and distortion would not occur. The ideal method would be able to supply a large specific heat input to maintain a constant desired temperature ahead of the tool. It would be low in initial and operating cost. It would be easy to control, easy to set up and not dangerous to the operator.

In the light of this ideal, various heating methods were evaluated during the tests. Through-heating in a gas or electric furnace, followed by machining, provides heating for the entire depth of cut, which is important in drilling and end milling. Since the workpiece is cooling unevenly during machining, however, distortion will occur and expansion calculations (for part size) are difficult.

Resistance heating, in which ordinary electrical current is passed through the workpiece or through resistance heaters embedded in the fixture, is simple and relatively inexpensive. It has the advantages of through heating. It can maintain the workpiece at temperature during the entire machining cycle.

Flame heating has been used since the inception of hot machining. In its simplest form, a welding torch is played ahead of the cutting tool. Localization of the heat with large heat inputs is difficult and there is also a possibility of surface damage due to flame splash or hot products of combustion playing over the newly cut surface.

Arc heating, using carbon or inert arcs, provides good concentration of heat both in depth and area. The equipment is relatively inexpensive. However, the control of heat to maintain a constant temperature is difficult and the light from the arc requires that protective equipment be used.

Radiant heating, employing quartz lamps to give off infrared or heat radiation, may become practical when improved bulbs and reflectors are available. At present, it is necessary to use voltages above the rated capacity of the bulbs to get adequate heating, and this shortens bulb life.

Induction heating, despite its relatively high initial cost, is still one of the most-used heating methods. In induction heating, a heating current in the workpiece is induced by transformer action, using a coil around or on one side of the work. It cannot be used with nonmagnetic materials.

Induction heating allows high specific heat input so that high temperatures can be reached in a short time. All of the heat is applied to a thin surface layer so that localization in depth of temperature is possible, although conduction occurs with time. The necessary size of the coil makes localization of the area of heating difficult. Since depth of penetration of the heating current is not great (about 0.002-inch penetration at 1000 kc or 0.020 inch at 10 kc in steel) difficulties may be encountered in some operations, such as drilling. The configuration of the workpiece may make coil design difficult.

Since none of these heating methods was completely satisfactory, studies were instituted to develop new methods. It was felt that passing the current directly through the workpiece instead of inducing the current would be more efficient if the path of current flow could be controlled.

Radio-frequency resistance heating appeared promising in this respect. The path of radio-frequency current flow can be controlled, since it follows the path of least impedance (the impedance is the vectorial sum of resistance and inductive and capacitive reactance). When two conductors, one of them of a magnetic material, are placed side by side, with current flowing through them in opposite directions, the lowest impedance on the magnetic material occurs where the two conductors are closest. Thus the current can be led in a controlled path designated by the position of the other conductor.

The radio-frequency resistance heating apparatus designed for testing used this principle to concentrate the current from a $\frac{3}{4}$-inch wide electrode to a path $\frac{3}{16}$ of an inch wide immediately ahead

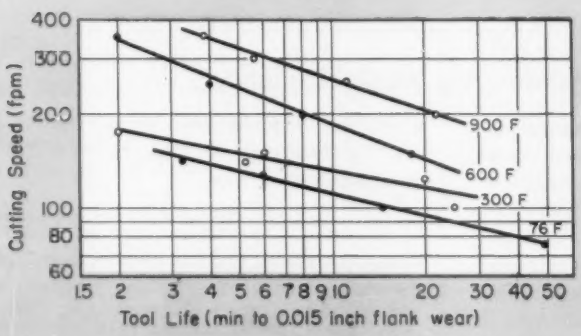


Fig. 8. Effect of temperature on tool life-cutting speed relationship. Material is AISI 4340 steel, induction heated, and turned at 0.008 ipr feed with a 0.100-inch depth of cut. Grade 350 carbide is used.

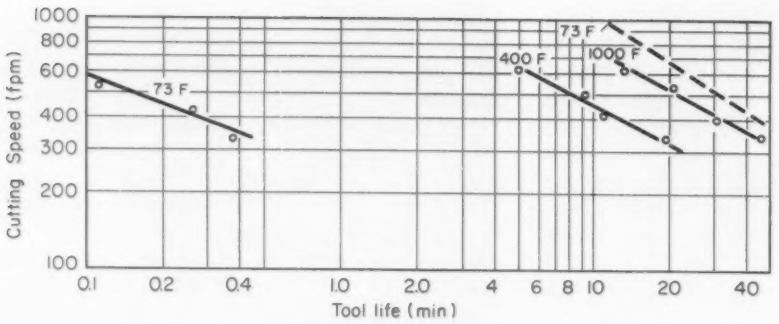


Fig. 9. Typical tool life-cutting speed curves for milling with a single-tooth cutter and 0.0065-inch fpr. Grade 370 carbide is used.

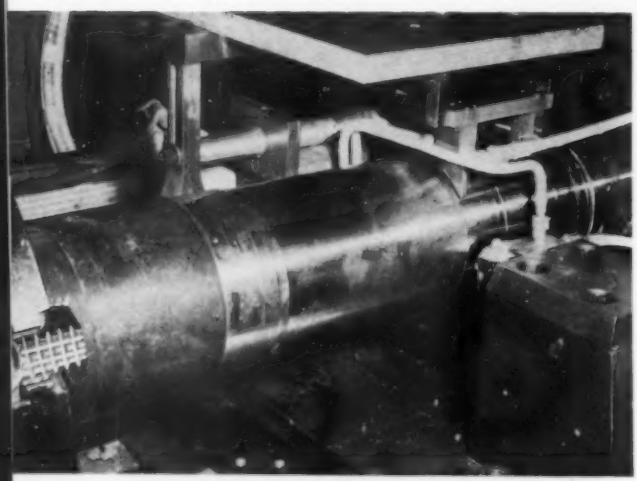


Fig. 10. Through-the-tool radio-frequency resistance heating turning apparatus.

of the cutting tool. Air cylinders hold the electrodes against the workpiece and there is little arcing between the workpiece and electrodes with low air pressure (15 psi) applied. "Through-the-tool" radio-frequency resistance heating was also tried out, *Fig.* 10. Excellent concentration of heat was obtained; however trouble was experienced with heating of the toolholder and toolpost by parasitic induction. These problems are being studied further.

Radio-frequency heating methods are only effective with magnetic materials. One method being presently considered for possible future use in heating low-permeability materials is plasma arc heating. The plasma arc heats a gas stream as high as 40,000 F using an electric arc. Good heat concentration is obtained. The disadvantages are intense light and noise, and the difficulty of exact temperature control. Further work may minimize these disadvantages.

Conclusions: No detectable change in microstructure was apparent on examination of hot-machined specimens, but microhardness checks showed that tempering occurred when the original tempering temperatures were exceeded. The depth of tempering varies with the material and the duration of heating. The finish of hot-machined surfaces was as good as that obtained when machining at room temperature although some surface oxidation was apparent at the higher temperatures used. Workpiece distortion presents a problem that can be overcome by better localization of heat.

The results obtained during the hot-machining tests show that there are no excessive safety or health hazards involved in hot machining, generally, and that there are many ways of controlling the heat source. Hot machining should be considered for immediate application on high-strength materials where conventional cutting is difficult. It definitely solves certain Space-Age metalcutting problems.

Tape Recorders Up Plant Efficiency

Many plants where workers perform several different jobs during the course of a day could benefit from an automated time-keeping system developed by National Electric Welding Machines Co.

At National Electric Welding's plant, some 225 production workers are employed. Individual workers perform several different jobs during the day.

Prior to installation of the automated system, it was necessary for the worker to check in and out with a timekeeper as much as four or five times a day. In reporting a job change, the worker lost a certain amount of time.

In the new system, workers report job changes by telephone. The information is recorded on tape. Fifteen telephones and four tape recorders are used. No worker is more than 25 feet from a telephone.

It is expected that the entire system will pay for itself within 18 months.



MACHINABLE CARBIDES solve wear PROBLEM

By **J. L. Ellis**, Vice President
S. Tarkan, Plant Superintendent
Sintercast Div.
Chromalloy Corp.
West Nyack, N. Y.

Wear parts made from a new family of machinable carbides can be produced in the average plant without difficulty. Performance under severe service conditions is excellent.

From Paper No. 306, "Applications of Steel-Bonded Carbides for Metal-working" to be presented at the 28th ASTME Semiannual Meeting. Copies of the complete paper will be available for purchase from Society Headquarters.

Fig. 1. Looper hooks for a carpet-tufting machine are produced on a compacting die in a tableting press.

COMBINING THE HARDNESS and wear resistance of carbide with the machinability of steel, steel-bonded carbides have demonstrated their cost-cutting potential on hundreds of production applications. These relatively new materials can be machined and hardened by standard in-plant methods, so the production of carbide tools, dies and wear parts is possible in any toolroom. For most applications, standard rectangular or round blanks are used; however, when large numbers of identical parts are required, special shaped blanks can be obtained to minimize machining.

The steel-bonded carbides are made by powder metallurgy techniques. The wear and abrasion-resistant phase is titanium carbide, one of the hardest and most stable materials available. A steel binder gives machinability to the composite material and makes it possible to attain desirable characteristics by heat treatment. Since steel is a magnetic material, steel-bonded carbides can be held by magnetic chucks for machining—an advantage over other carbides.

Another attractive characteristic of steel-bonded carbides is their dimensional stability during heat treatment. Due to their high carbide content, these materials do not shrink or become distorted during hardening. Parts made of steel-bonded carbide can, therefore, be machined to extremely close tolerances before heat treating. An allowance of as little as

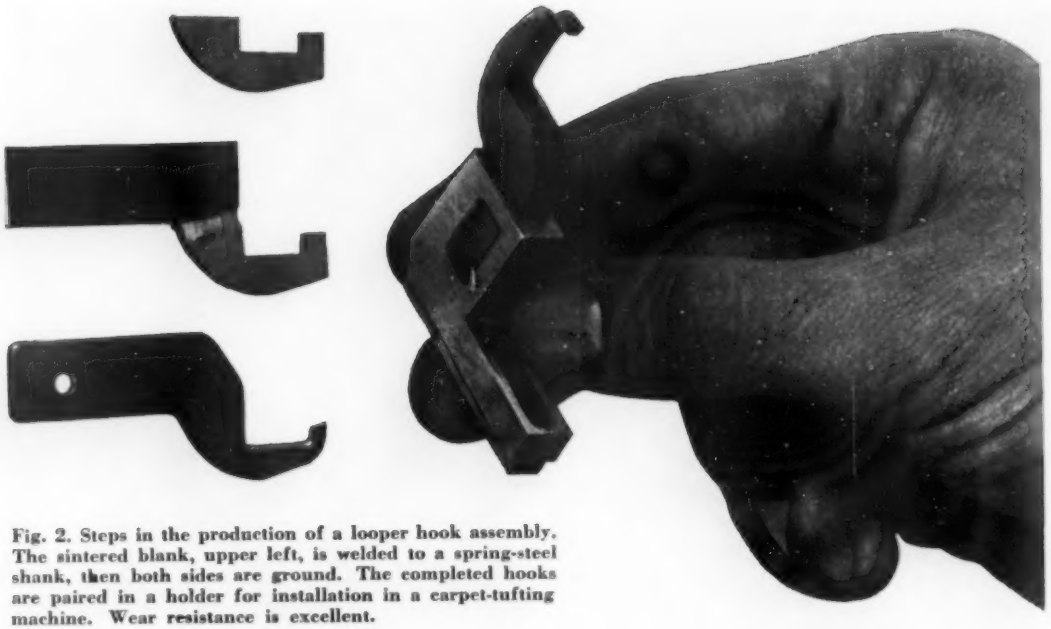


Fig. 2. Steps in the production of a looper hook assembly. The sintered blank, upper left, is welded to a spring-steel shank, then both sides are ground. The completed hooks are paired in a holder for installation in a carpet-tufting machine. Wear resistance is excellent.

0.0005 inch for post heat-treat finish grinding is not uncommon. Often no finishing at all is required after hardening. Heat-treating procedures are the same as those used for tool steels, with special precautions being taken to prevent decarburization.

A further advantage of steel-bonded carbides is the ease with which they can be joined to other materials. Welding by the Heliarc or argon-shielded arc processes gives good results, as do brazing and cementing with epoxy resins.

The versatility of steel-bonded carbides is illustrated by the production of looper assemblies for carpet-tufting machines. The most important part of the assembly is a pair of hooks that retain yarn loops. The loops are fed over the tips of the hooks by a needle. The bottom of each hook is a cutting edge. Working against this edge, as in a pair of scissors, is a knife blade that clips the last loop on the hook. When the edge loses sharpness, the yarn loop is not cut and trouble results.

Until recently, all looper hooks were of tool steel. Because of the cost of downtime for changing hooks, twenty steel-bonded carbide hooks were fabricated and tried out to see if better performance could be obtained. These hooks were examined after they had lasted three times as long as the conventional tool-steel hooks and no wear could be detected. Consequently, it was decided to replace the entire set of 1300 tool steel hooks with carbide hooks.

The test hooks were machined from standard rectangular blanks. Because of the large number of hooks required, however, shaped blanks for the full set of hooks were produced on a compacting die. This compacting die, *Fig.* 1, is made from the same steel-bonded carbide material as the hooks. Both die sections were machined to size from annealed material, then heat treated. No subsequent finishing was required.

After being compacted in the die, the shaped blanks are vacuum-sintered. Next, they are surface-ground to remove scale. About 260 blanks are placed on a magnetic chuck and processed simultaneously. After grinding, the blanks are chucked individually and Heliarc-welded on both sides to an annealed spring-steel shank, *Fig.* 2. Then the blanks are again magnetically chucked in batches of 260 pieces for finish edge grinding.

Following edge grinding the blanks are hand-machined to final shape and each hook tip is torch hardened and tempered to R_C 70. Subsequently, the hook-shank assembly is finish-ground on both sides. Once they are paired in their holder, the looper hooks are ready for installation in the carpet-tufting machine.

While the carbide looper costs about 25 percent more than a tool steel looper, the fact that it lasts three times longer has resulted in impressive savings. Also, the reduction in downtime has been substantial. Replacement of 1300 loopers requires four hours with a crew of six men. Thus when a set of tool steel loopers is replaced by a set of carbide loopers, at least eight hours of downtime and 48 maintenance man-hours are saved per set of loopers. Large dollar savings result.

Coolant Performance Compared

mist

flood

air

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and
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Significant improvement of metal removal generally results from using mist coolant. But quantitative performance data reveal that flood cooling or dry cutting can provide better performance for certain feed and speed combinations.

BECAUSE NOTABLE improvements in cutting can be obtained by using coolants, the authors have investigated the effects of three different coolants over a range of cutting speeds. Effects of the different coolants are analyzed by measuring force components, by calculating power and energy expended in cutting, by measuring chip thickness and wear lands. Results achieved pinpoint for the tool engineer both the speed ranges most susceptible to improvement by each coolant and the effect of the coolant on various machining factors.

Performance Measuring: The performance measuring setup shown in *Fig.* 1 is a new three-component machining dynamometer. A schematic, *Fig.* 2, shows details of the sensors and the means by which cutting force components are detected. Strain-gage outputs were converted into the mutually perpendicular components by using dynamometer calibration equations. From the tangential, axial and radial components of cutting force, the shear power, friction power, total machining power and specific cutting energy were calculated. Chip thickness data were also obtained and the chip-cutting ratio determined. Separate tool-life tests were conducted and wear-land data collected. From these measurements and calculations, the relative effect of the three coolants on nine machinability factors was established as a performance guide.

Tool and Workpiece: The workpiece, of SAE 1045 hot-rolled steel, 36 inches long with an 8-inch diameter, was turned down to approximately a 6-inch diameter to remove the outer skin and provide a concentric cylindrical surface. A light finish cut was taken to insure removal of any surface material that might have been work-hardened by the rough machining. Cemented carbide turning tools (Kennametal Type KM) having the geometry shown in *Fig.* 3 were used. The cutting edge of the tool was oriented perpendicular to the direction of relative motion between the tool and workpiece, as shown in *Fig.* 4. The nose radius was kept at 1/64 inch.

Cutting Conditions: Three cutting media were tested: (1) ambient air; (2) a liquid stream of one part of soluble oil in 20 parts of water flowing at



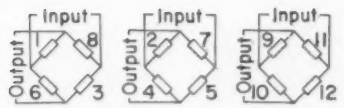
Fig. 1. Setup for measuring performance of three different coolants.

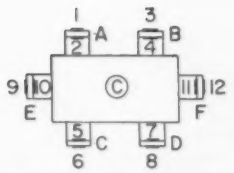
2 gpm to provide a copious supply of liquid with a minimum of splashing; and (3) a mist of one part of mist cooling liquid (soluble oil with an average water-to-oil ratio of 35 to 1) in 5000 parts of air at a rate of 0.0022 gpm of liquid droplets in 1.5 cfm of air. The coolant being tested (flood or mist) was directed at the back of the chip in the region of demarcation between the chip and the workpiece, as this method of application has been found to be both practical and effective. For mist cooling, 25 psi pressure was used.

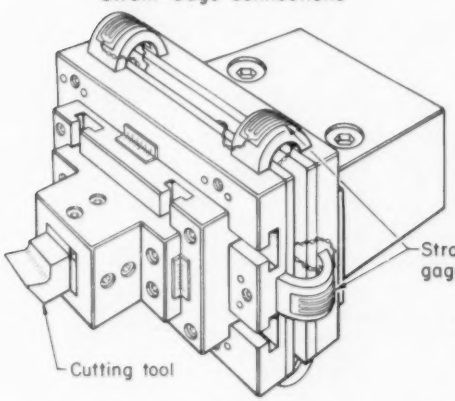
After preparation of the workpiece surface, a complete set of data was obtained under dry cutting, mist and flood cooling conditions for every combination of the five speeds (from 150 to 750 fpm) and five feeds (from 0.0029 to 0.0144 ipr) that were used. A constant 0.125-inch depth of cut was maintained throughout the tests.

Test Results: Results obtained are presented in an abbreviated graphical form in *Figs.* 5 and 6. For simplicity, only the highest and lowest feeds are shown. Droop in some of the force curves and scatter in chip-cutting ratio data at low feeds are attributable to a change in the type of chip formation. Instead of the continuous ribbon obtained under favorable cutting conditions, a segmental or tightly coiled chip was obtained or some built-up edge was observed. Also, a certain amount of tool vibration occurred. Comments regarding the results are limited to the most significant trends.

Tangential force determines the stiffness required of the tool and tool-support structure and chatter control characteristics of the machine tool. It is primarily responsible for the pressure exerted by the chip on the tool face and hence it is against this force that the tool must be supported. It is the only force component that contributes in a practical sense to the total power consumption in machining. Also, tangential force is the major force which deforms the workpiece into the chip and contributes to the heat generated at the tool-chip interface, to land wear, tool-cratering and tool-edge chipping. In comparing the effects of mist and flood cooling, *Fig.* 5a, with dry cutting, mist lowers F_t







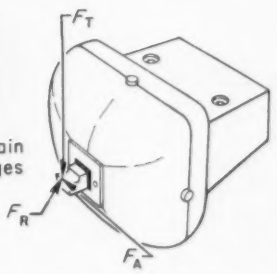


Fig. 2. (left) Details of three-component machining dynamometer.

Fig. 3. (center) Geometry of cutting tool used in measuring coolant performance.

Fig. 4. (bottom) Cutting force components acting on the lathe tool during tests.

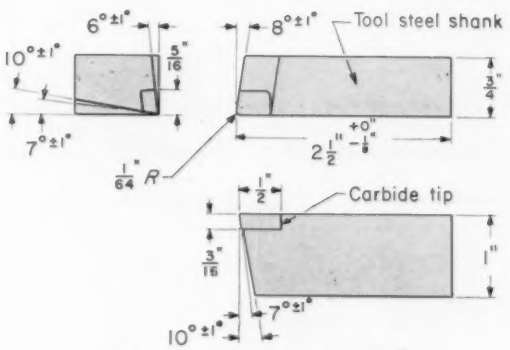
(tangential force) at the lower cutting speeds (below 200 fpm) and flood cooling lowers F_t at the higher speeds (beyond 400 fpm). In the mid-range, no great differences in F_t were caused by a change in coolant.

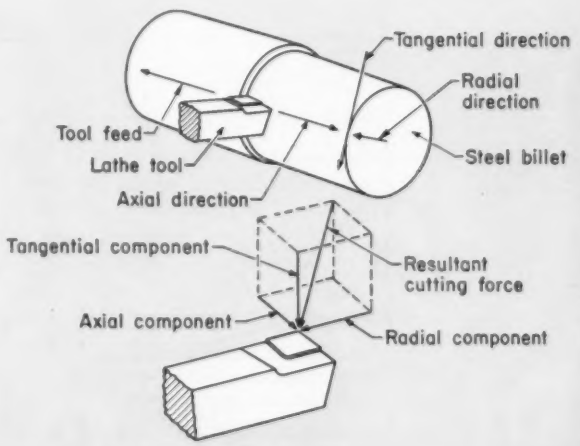
Axial force, F_a, drives the tool into the machined shoulder of the workpiece and plays a major role in the friction present between the tool and chip, and tool and workpiece. Although F_a represents a minor part of the energy required to shear the chip from the workpiece, it is the second major factor (after F_t) in the heat generated at the tool-chip interface. As shown in *Fig.* 5b, axial force was reduced by mist cooling at speeds above 650 fpm at the heaviest feed and at all but the slowest speeds for the 0.0029-ipr feed. At the lowest feed, flood cooling consistently reduced F_a.

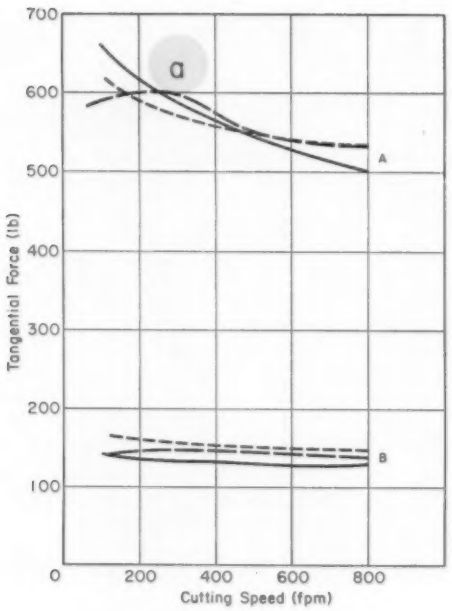
Radial force , F_r, is present in oblique cutting and when there is a nose radius on the tool. Mist cooling reduced it the most at higher speeds and flood cooling was most effective in the mid-range of speeds, *Fig.* 5c. Flood cooling was also the most effective at low speeds with a 0.0029-ipr feed.

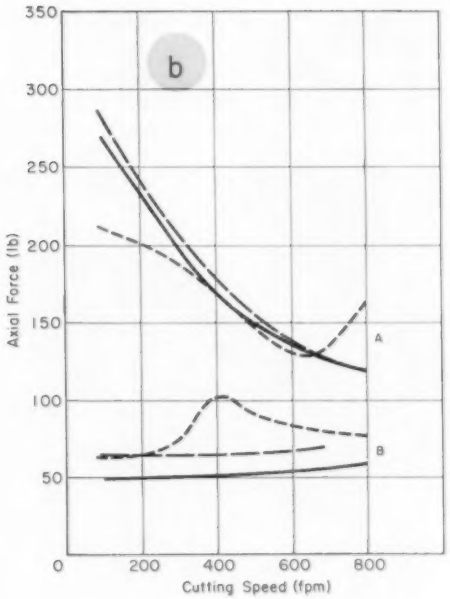
Shear power, computed from the calculated shear force and velocity, represents that part of total cutting power expended in the formation of the chip. In general, shear power determines tool temperature at low cutting speeds and thus tool life. As indicated in *Fig.* 5d, shear power was generally the least when flood cooling was used. But at the lower speeds and higher feeds, the use of either mist or flood cooling did not result in any significant reduction of shear power.

Friction power, shown in *Fig.* 5e, was calculated





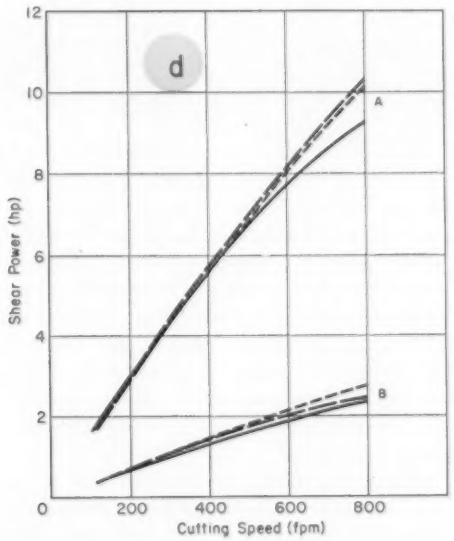


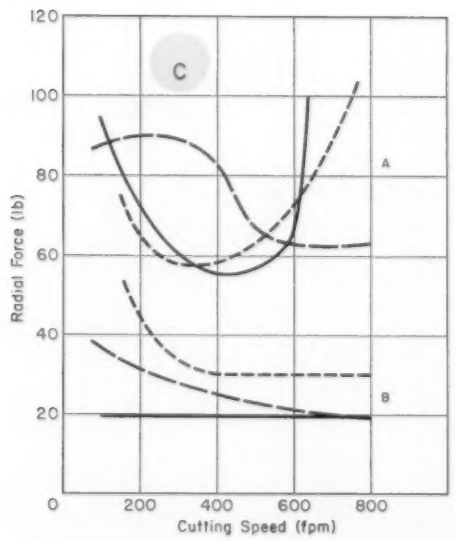


Dry cutting
Mist cooling
Flood cooling

A=0.0144 ipr B=0.0029 ipr

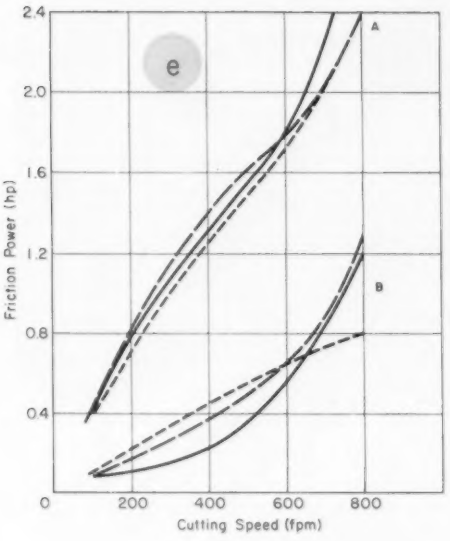
Fig. 5. Effects of three different types of cooling on machinability factors.

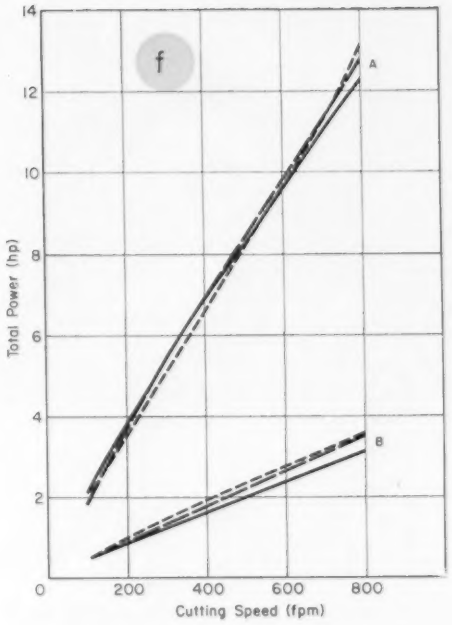


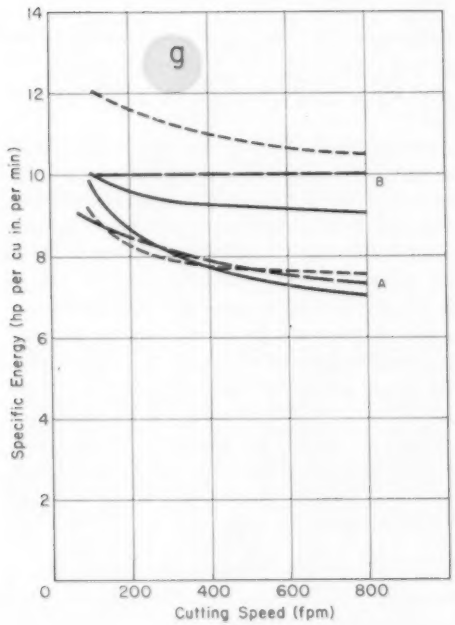


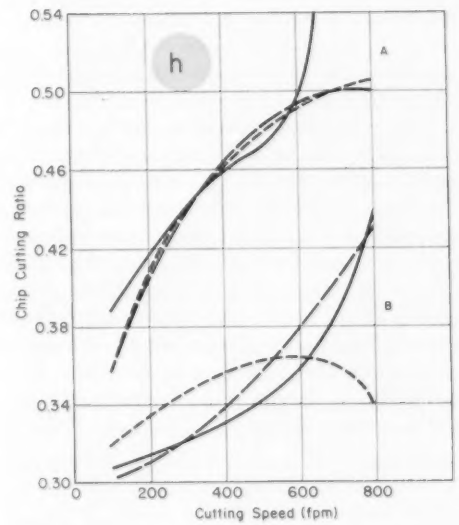
by subtracting shear power from the total power consumed during cutting. Friction power is the fraction of total power dissipated in friction between the tool and chip. In general, friction power determines tool life at high cutting speeds. At the lowest feed and at speeds below 600 fpm, both mist and flood cooling reduced friction power, flood cooling being the more effective. Otherwise, the effect of mist or flood cooling on the friction power was either negligible or detrimental.

Total power consumed was calculated from tangential force and cutting speed, and is shown in *Fig.*









5f. It determines lathe horsepower and is one of the factors that determine machining cost. It indicates the heat dissipated into the workpiece, chip and tool. Mist cooling reduced total power at the heavier feeds. Flood cooling reduced total power for the entire range of feeds and speeds.

Specific energy, *Fig.* 5g, was calculated by dividing total power by the rate of metal removal. Specific cutting energy is the total work done in removing a unit volume of workpiece material, and provides a common basis for comparison of different cutting conditions. Both mist and flood cooling resulted in a reduction of the specific energy at the lowest speed and lightest feed. Flood cooling was in general superior, particularly at speeds above 400 fpm and the lower feeds.

The chip-cutting ratio was obtained by dividing feed by the average chip thickness. Generally, an increase in the cutting ratio is accompanied by a decrease in the energy required to shear the material and by a decrease in the friction power. This can, however, be offset by an increase in the pressure on the tool and a decrease in the contact area between tool and chip, whereby a rise in tool temp-

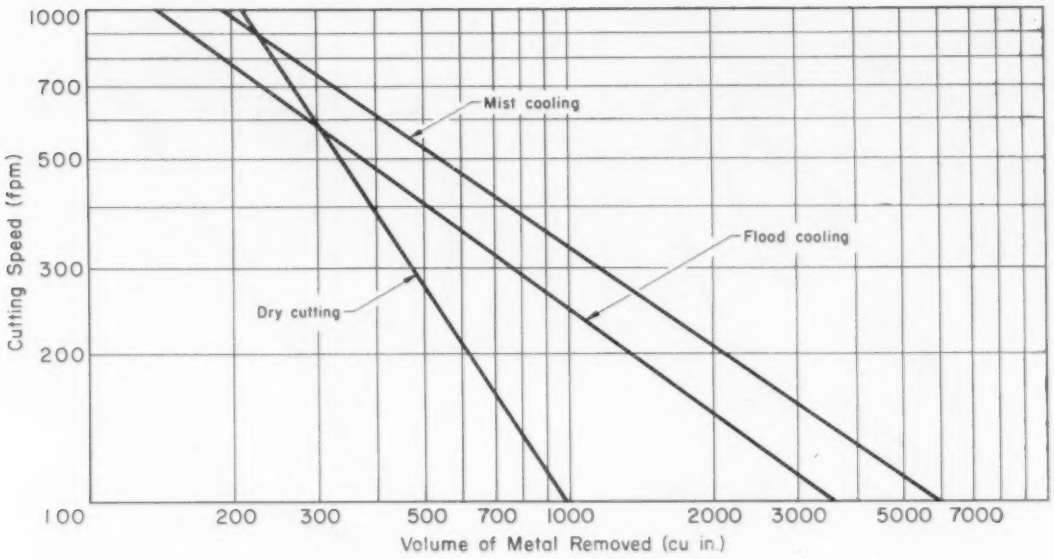


Fig. 6. Performance of the three cooling media on the volume of metal removed.

erature and a consequent decrease in tool life would result. Flood cooling, as shown in *Fig.* 5h, was most effective at the higher speeds. Mist cooling was most effective at low feed-high speed combinations.

Volume of metal removed at a given cutting speed for a land wear of 0.030 inch was plotted against cutting speed on a log-log chart to obtain *Fig.* 6. For minimizing land wear (or maximizing tool life), the line in *Fig.* 6 that is farthest to the right and the closest to vertical is the best. Comparing performance of the three coolants in terms of this criterion, mist and flood cooling have approximately the same slope, but mist cooling gives better tool wear as the mist cooling line is farthest to the right. The dry cutting line is steepest; it intersects flood cooling at 590 fpm and mist cooling at 900 fpm. Thus, under these conditions, dry cutting will remove more metal per tool than flood cooling at speeds above 590 fpm, and is superior to mist cooling at speeds above 900 fpm.

In general, mist cooling provides significantly better tool life over most cutting speeds, reduces cutting energy at low speeds and light feeds, raises the chip-cutting ratio at higher speeds and reduces tangential force at the lowest speeds and feeds. Flood cooling is second best in improving tool life at speeds below 590 fpm, is generally superior to mist cooling in reducing specific cutting energy, is better than mist cooling in its effects on the chip-cutting ratio at speeds above 600 fpm and heavy feeds, and is more effective than mist cooling at reducing tangential force at the higher speeds. At certain combinations of feeds and speeds, dry cutting gave better machinability factors than either mist or flood cooling, and should be used.

Fuel Cells To Be Developed

To advance fuel cell technology, a long term research program has just begun at Battelle Memorial Institute. The program will be fundamental in nature, because the fuel cell's full potential cannot be realized as a source of power for automobiles, domestic heating and cooling and industrial processes until after there have been a number of inventions, innovations and breakthroughs.

Extended service is one of the advantages ascribed to the fuel cell—but its prime advantage is the efficiency with which a fuel cell can convert fuel to energy. Efficiencies of 75 percent have been demonstrated in experimental fuel cells, as compared with 40 percent in steam turbines, 35 percent in diesels, and 25 percent in spark ignition engines. Similarly, the fuel cell offers an attractive energy-to-weight ratio. The cell itself contains no moving parts, is simple in design, can be built to meet specific space and shape requirements and requires a minimum of mechanical maintenance. In operation, the fuel cell is silent and gives off no objectionable waste products. Though present interest centers on a cell using a mixture of hydrogen and oxygen as its fuel, scientists believe cells can be built to use a wide variety of fuels, including petroleum products. The program is supported by 25 companies.

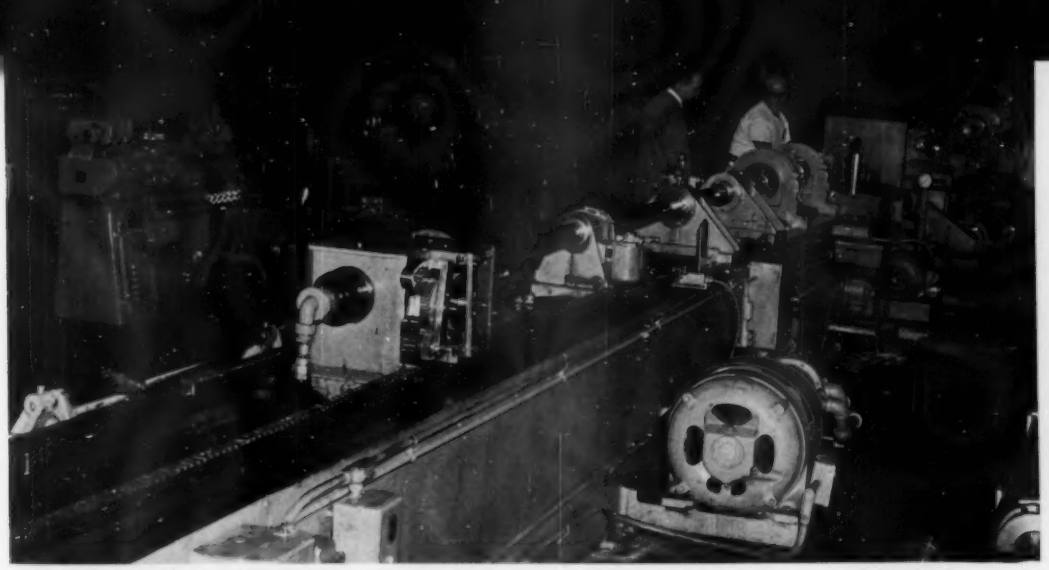


Fig. 1. Geared rifling machine. Gearbox on bed synchronizes rotation and advance of rifling bar.

Modern Machining of Cannons — a new concept in rifling

By **E. L. Goerold**, Section Leader
J. Ropitzky, Project Leader
Watervliet Arsenal
Watervliet, N. Y.

Machining rifle bores for heavy ordnance is traditionally expensive, time consuming and inefficient. A new method of production is economical and precise. This change became possible when tool engineers at Watervliet Arsenal discarded all the old rifling concepts and started from scratch.

RIFLING IN MODERN ARTILLERY imparts a spinning motion to a projectile. The resulting gyroscopic effect of this eliminates the pitch and wobble which normally occur when a projectile is fired from a smooth-bore gun. Two of the methods used to machine the rifle helix are far from modern. They are the ribbon rifling process and the fixed-key production process. A third method, geared rifling, *Fig.* 1, is entirely new and probably will supersede the first two in the manufacture of artillery.

Ribbon Rifling: Ribbon rifling machines are the oldest types currently used to cut rifling. Schematically diagrammed in *Fig.* 2, these machines have two functions: to rifle prototype cannon and to cut master helical grooves in rifling bars. The latter are essential components in the operation of production type rifling machines, *Fig.* 3.

In operation the ribbon rifling machine translates linear motion from the ribbon development to a rifling bar. This is accomplished by a ribbon follower which bears against the ribbon. The ribbon follower is connected to the end of a gear rack which actuates a pinion gear, transmitting rotary motion to the rifling bar through a gear train.

When the ribbon rifling machine is prepared for operation, a major problem is encountered in setting the ribbon to produce the required helix or spiral. If the required rifling helix is a constant lead (rifling that progresses with a uniform spiral throughout the full length of the barrel), the ribbon forms a straight line at an angle to the machine axis. If the required rifling helix has variable lead, the ribbon will lie in a compound curve and straight line. In this way, the curved portion of the ribbon represents accelerated rotation and the straight section a constant rotation. Normally 16 to 24 manhours are required to set the ribbon to the desired curvature and generate a helix.

It is often necessary to reduce the large layout

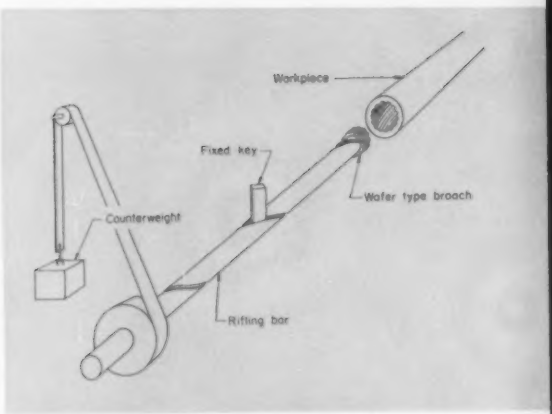


Fig. 2. Diagram of ribbon rifling machine. Curved ribbon provides variable lead to rifling bar advance.

angles required so that the ribbon can be located within the bench width of five feet. To compensate for the reduction of ribbon angle, the gear ratio of the change gears, *Fig.* 2, must produce an increase of motion so that the required lead will be developed. The unit pressure of the ribbon follower against the ribbon is directly proportional to the gear change ratio and this value is sometimes as high as 6 to 1. Because the maximum ratio at which the ribbon rifling machine functions satisfactorily is approximately 3 to 1, ribbon rifling is definitely limited in its applications.

Disadvantages of the ribbon rifling system are:

1. Forces developed at ribbon follower affect operation
2. Inaccuracies of ribbon setup cause lead errors
3. Repeatability between setups is poor
4. Operation requires excessive setup time
5. Specialized skills are required
6. Floor-space requirements are excessive

These objections make ribbon rifling machines impractical for prototype work and production.

Production Rifling: The second method used to produce rifled cannon barrels is through the use of a production type rifling machine illustrated in *Fig.* 3. This machine, schematically diagrammed in *Fig.* 4, is dependent upon grooved rifling bars for operation and is used when high volume is required. At Watervliet Arsenal the grooved bars are generated on the ribbon rifling machine, thereby making the production machine dependent on the ribbon machine.

The grooved bar, rotated by a fixed key, controls the helix generation in this machine. In operation, a series of disk or wafer broaches are pushed individually through the stationary gun tube to produce the rifling. The broach operates as a fixed unit with the rifling bar and produces a lead in the gun bore equal to the lead of the helical groove in the rifling bar. The counterweight takes up backlash in the system, maintaining a constant pressure between the grooved bar and the fixed key.

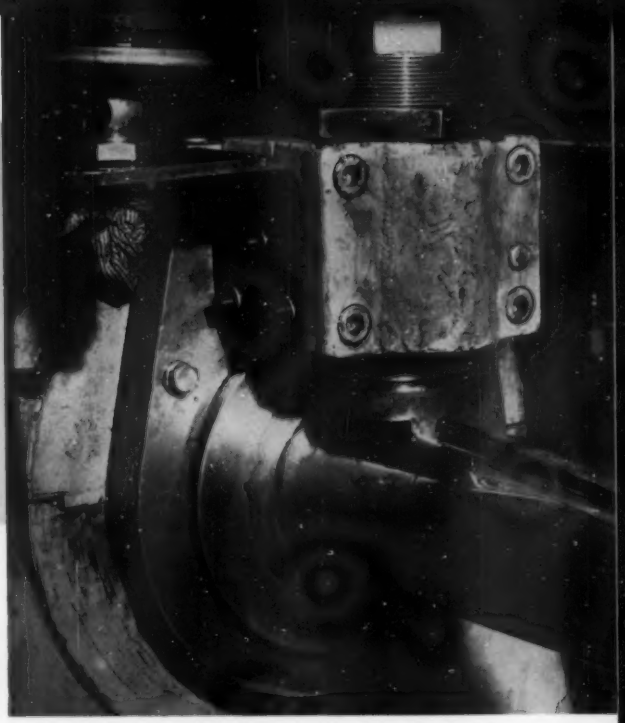


Fig. 3. Fixed-key production rifling machine. Advancing rifle bar is turned by key in helix slot.

Geared Rifling: In an effort to reduce manufacturing costs and to improve rifling operations, Watervliet Arsenal initiated a project to develop a new rifling mechanism that could be adapted to existing broaching machines. After careful study of all factors involved, Arsenal tool engineers determined that constant lead rifling could be most efficiently produced by gearing. The machine envisioned would be divorced from, and independent of, both its predecessors, relatively compact, and able to machine any standard Army helix.

In developing this machine, illustrated in *Fig.* 1, Arsenal engineers utilized a standard 6-pitch spur-gear rack and pinion to produce bar rotation. A four-gear quick-change system, *Fig.* 5, was selected because it would accurately produce most of the desired leads. To translate gear-train motion into rifling bar rotation, a 10 to 1 worm-gear unit was used. This unit is incorporated into the mechanism between the change gears and the output rifling bar to cover the rifling ranges most often encountered in standard Army cannon.

Because indexing is sometimes necessary in prototype work, an indexing unit is placed forward of the drive unit. This mechanism incorporates a cone worm-gearing unit with a rotary accuracy of 0.25 deg for angular repositioning of the rifling bar.

A simple friction type adjustable brake mechan-

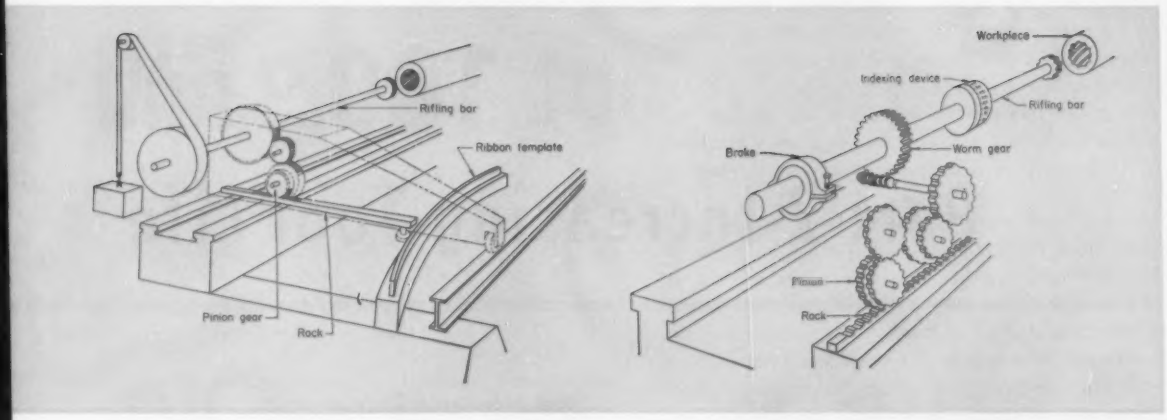
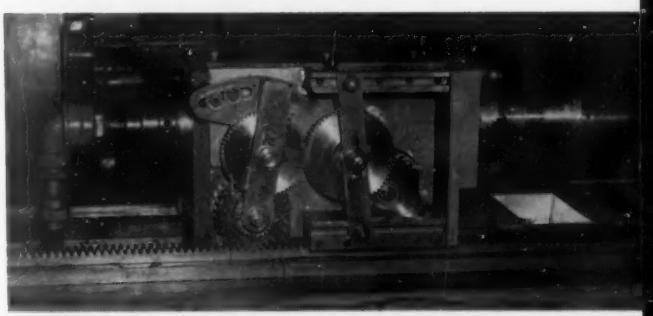


Fig. 4. (above) Fixed-key rifling mechanism.

Fig. 5. (upper right) New geared-rifling mechanism. Advance of unit on rack causes bar rotation.

Fig. 6. (right) Gear train for turning rifling bar. Unit is mounted on conventional broaching machine.



ism is installed directly on the rifling bar, in the main bar drive unit. A brake takes up any backlash from the gear transmission and is readily accessible for wear adjustment.

This gearing mechanism has been adapted to a 15-ton hydraulically driven American horizontal broach rifling machine and has been successfully used at Watervliet Arsenal to produce the weapons with leads ranging from 82.68 to 708.60 inches in bore sizes from 106 to 90 mm.

Gear Ratio Selection: Logarithmic calculation is generally considered the most accurate method of determining required gear ratios. It is also simple to apply. A typical example of the problems incurred involves the selection of gears for generating rifling in a 90-mm gun tube with one turn in 25 calibers.

The circumference at the pitch line of the 6 diametral pitch prime input pinion gear is 15.708 inches. However, this dimension is reduced by the 10 to 1 worm-gear reduction unit to one-tenth of this value, thereby rotating the bar spindle one-tenth revolution. To obtain complete rotation of the bar spindle it is necessary to rotate the pinion ten times. Therefore, the basic lead of the machine is 10 times 15.708 inches or 157.08 inches per revolution. Next, it is necessary to evaluate the lead in inches. This is the numerical value of one turn in 25 calibers on a 90-mm gun tube and it is obtained by multiplying 3.543 inches—the English equivalent of 90 mm—by 25. The lead is 88.575 inches.

The gear ratio, obtained by dividing 88.575 by 157.08, equals 0.56388. Evaluated in logarithms, these values produce a ratio logarithm of 0.248809.

In each pair, gears should be approximately equal, *Fig.* 6. Therefore it is necessary to select a set of gears with a logarithm equal to approximately one-half the logarithm ratio. From a logarithm table, log 42:30 tooth gears = 0.146128. This value subtracted from the ratio log 0.248809 leaves a remainder of 0.102671. The table shows a 38:30 combination to have a logarithm of 0.102662, a value within 0.000009 of the exact logarithm.

The choice of change gears selected can be proved by the following procedure:

$$\frac{30}{42} \times \frac{30}{38} = 0.56391 = \text{actual ratio}$$

Since the desired ratio is 0.56388 the actual ratio 0.56391 represents an error of only 0.00003.

Many advantages result from the use of geared rifling machines. The major ones may be summarized as follows:

1. Easy conversion from one lead to another
2. Elimination of frictional forces at the ribbon follower
3. Economies in floor space
4. Greater torque strength in rifling bar
5. Efficient work from less highly skilled operators.

Other advantages too numerous to itemize are found if the comparison between geared and ribbon type rifling is continued to its conclusion. Of more significance is the fact that rifling as a technique has matured from a highly specialized craft to a routine machining operation.

how to cut TOOL and Part 2-Increasing Tool Life

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Steel selection, surface finish, toolmaking techniques and heat treatment are important variables influencing tool life. This article explains the ways in which these variables can be controlled to reduce costs.

EXTENDING SERVICE LIFE of tools and dies is one of the most important economies that engineers can make. Prolonged tool life reduces die requirements for long production runs. Increased output between grindings reduces machine downtime and economizes on grinding costs.

Obtaining longer tool life is relatively simple. It requires no additional steps in toolmaking or heat treating—only the observation of certain practices. These are: proper selection of tool steel, correct heat treatment and the utilization of a few simple tips regarding toolmaking.

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Steel Selection: There are many steels which can be classified as wear-resistant steel. Although most of them are highly resistant to wear, not all of them are suitable to tool and die fabrication. In addition, tools and dies which show superior characteristics of wear resistance are not always made from wear-resistant steel. To obtain prolonged tool life in many applications it is necessary to use steels which combine hardness with toughness. This combination depends on the die operation itself. As an example, the die illustrated in *Fig.* 1 blanks, forms and pierces oval muffler heads from 20-gauge cold-rolled steel. Maximum wear resistance is necessary on the tool surfaces that form the metal and toughness is required to prevent chipping on the edges during blanking and piercing. In this die, maximum wear resistance and toughness were obtained by selection of an air-hardening steel, AISI Type A2, which yields production runs of 100,000 pieces per grind.

In some instances toughness is not required in die sections and in these cases the wear-resistant steels can often give outstanding service. As an example, the washers shown in *Fig.* 2 were formerly pierced by drill rod punches cutting against an oil-hard Type O2 plate. Daily output from this setup was approximately 17,000 parts. Because the material stamped in this operation is highly abrasive and tolerances are close, downtime for punch

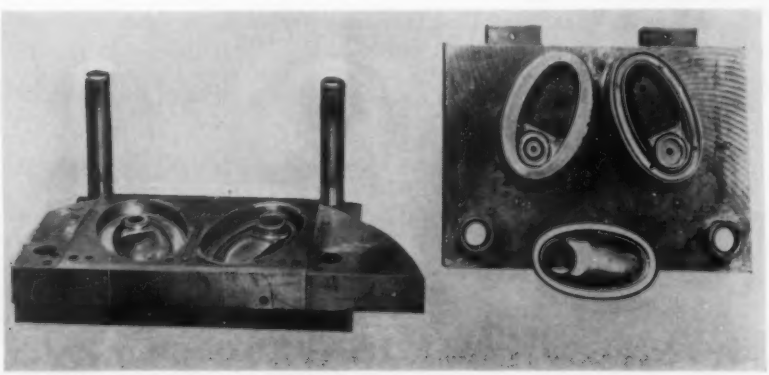


Fig. 1. Compound blank, form and pierce die for fabricating muffler heads.

grinding became excessive. However, this problem was easily corrected by substitution of an oil wear steel, Hampden AISI Type D3, for drill rod. Highly resistant to abrasion, this material eliminated excessive downtime and enabled the manufacturer to meet production requirements of 200,000 per day. Duplicate punches and die buttons enable setup men to change cutting sections within a matter of minutes, so production is practically continuous.

After requisite hardness and toughness have been determined, steel selection should be based on hardening depth and accuracy. Normally, these two factors go together. Steels which harden accurately show hardening depth and those with outstanding depth-of-hardening characteristics generally harden accurately. Hardening accuracy is especially important in minimizing or eliminating rework operations subsequent to hardening.

Die Design: Premature breakage in tools is often caused by sharp corners and machine marks. Pneumatic tools are especially vulnerable to this type of failure. In the example shown in *Fig.* 3 fracture started under the collar, originating in a machine line which had not been removed. Removal of all machine marks by polishing will extend tool life since surface flaws of any type serve as nucleii for fatigue failure.

Proper selection of stock size is also important in preventing component failure from cracking. Essentially this means that raw stock should always be large enough to provide for machining of sections on all sides. This is necessary, especially in cutting sections because all hot-rolled and forged tool steels have thin layers of decarburized metal at their surfaces. If, for reasons of size, this layer is used, component failure is certain to result although the material itself may be highly satisfactory. An example of this is shown in *Fig.* 4. This die section was made of bar stock whose rough dimensions were only slightly larger than the finished size of the section. The inevitable result was fracture originating in the decarburized area and extending through the "good" steel.

Depth of decarburization normally varies according to the size of the bar, as shown in the table. For rectangular sections where the width is less than four times the thickness, the thickness should be used as the dimension of the bar. When the width is greater than four times the thickness, the amount of stock removal should be doubled.

Effect of Heat Treating: In addition to proper selection of steel, consistent use of good heat-treating pratices is mandatory in extending tool life. This includes exact temperature control in both hardening and drawing operations, proper soaking time and correct consistency of quenching media. Several points concerning temperature control should be emphasized. First, if hardening temperatures are too low, or drawing temperatures too high, soft spots will occur throughout the section. Second, tool steel should never be drawn until it has been cooled sufficiently to be handled manually. Allowing it to cool to handling temper-

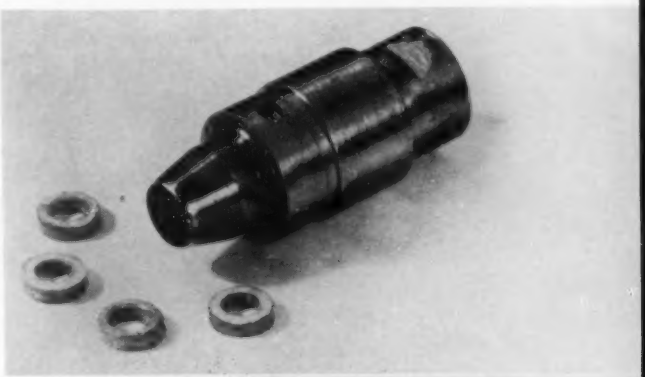
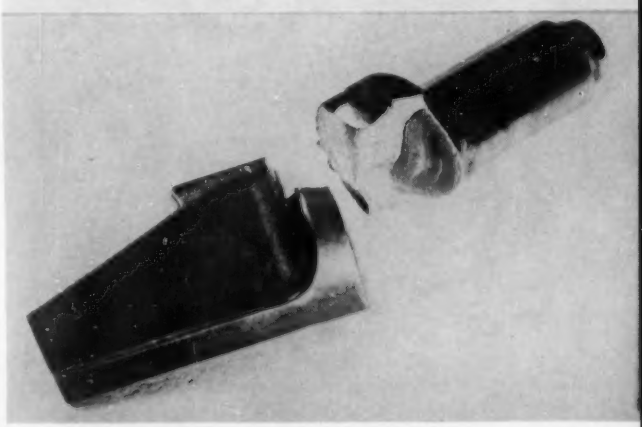


Fig. 2. Washers and die component for piercing center hole. Highly abrasive washer material requires wear-resistant die steel.

Fig. 3. Broken pneumatic tool used in impact application. Fractures of this type originate in machining marks.



ature assures completion of the hardening process. However, hardened components should not be permitted to remain indefinitely at room temperature. If it is impractical to draw them immediately after hardening, they should be stored in a warm bath of quenching oil. Even here, storage should be limited to no more than two hours, if the draw is to have maximum effectiveness.

Decarburization as a result of uncontrolled furnace atmosphere is also critical in its effect on tool life. This is shown in the two diagrams in *Fig.* 5. The shading at the left illustrates the uniform distribution of carbon in punch and die before hardening. The same punch and die, partially decarburized after hardening in an uncontrolled atmosphere, is shown at the right. Carbon content has decreased from 0.90 to 0.70 percent. Since surfaces are only partially decarburized, these sections may show a reading of R_C 60 or more. However, the cutting edges are low in carbon even after "cleanup," and excessive wear at these surfaces will result. It is this low-carbon skin that determines the life of the tool.

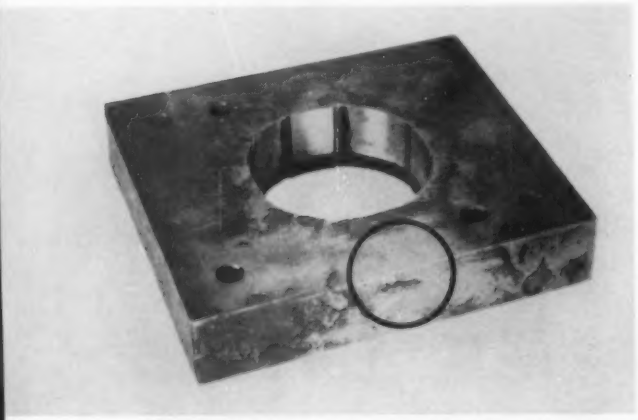


Fig. 4. Hairline fracture resulting from insufficient bark removal. Cracks starting in this way continue through decarburized area into "good" steel.

Bark Removal

Dimension of Bar (inch)	Minimum Amount to be Removed per Side (inch)
0 to ½	1/64
½ to 1¼	1/32
1¼ to 3	1/16
3 to 5	1/8
Over 5	3/16

Although decarburization is most critical in piercing dies, it is also destructive in bending, drawing or forming dies. Depending on die operation, it causes the early appearance of scratches, loading and galling. However, care must be taken in avoiding decarburization for it is also possible to obtain too much carbon—a factor just as destructive as decarburization.

Furnace atmosphere that prevents decarburization of surfaces increases the service life of tools and dies while reducing the frequency of grinding operations. Controlled atmosphere and neutral salt bath heat-treating equipment in use today will reduce the tendency of scaling and when properly adjusted will minimize surface decarburization.

Prolonged tool life is assured by using the optimum combination of drawing temperature and time. This combination is necessary to obtain the best balance between hardness and toughness, two critical factors in die sections subject to heavy impact. For any given soaking period, there is one, and in some instances two, drawing temperatures for peak toughness. For example, *Fig.* 6 shows the effect of drawing temperatures on torsional impact for two steels—Carpenter Stentor, a manganese oil-hardening tool steel, and Carpenter No. 484, a 5 percent chrome steel. Both are in the relatively hard category, with Stentor being an oil-hard and No. 484 an air-hard tool steel. The Stentor curve exhibits one toughness peak while the No. 484 shows two such peaks.

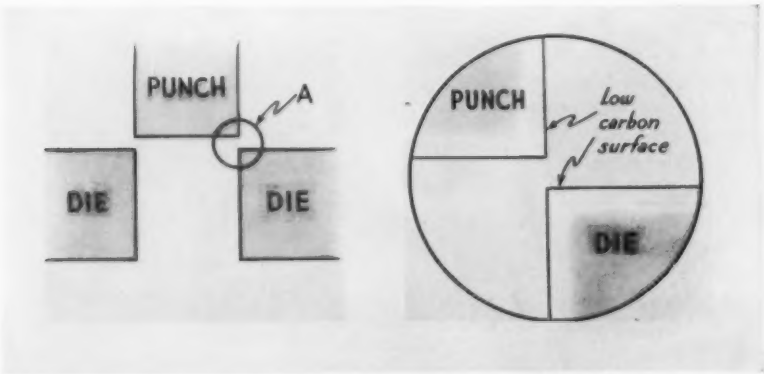


Fig. 5. Effect of carbon distribution on tool life. Sections finished to size are especially vulnerable to shortened life from decarburization.

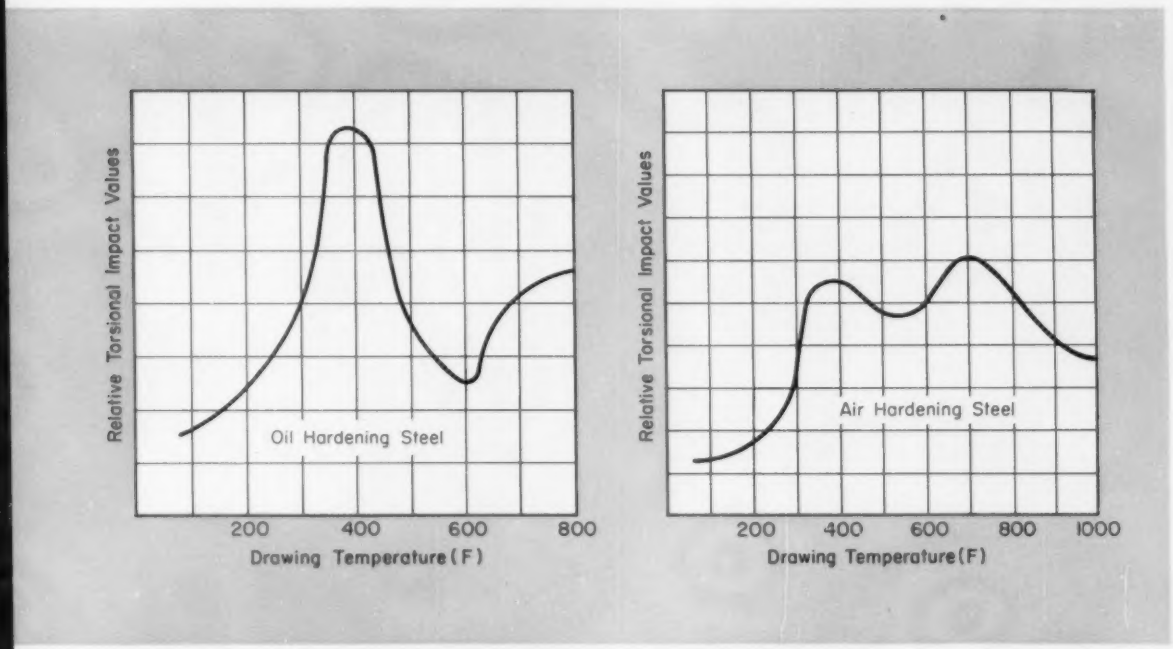


Fig. 6. Effects of drawing temperature on torsion impact. Steels are drawn for one hour at heat. Chart at left shows oil-hardening steels, that at right shows double-peak reaction of air-hardening steels.

The statement on the exclusiveness of drawing temperatures for any given soaking period has its corollary—"The longer the soaking period, the lower the drawing temperature." Large-size tools should be drawn longer than one hour. However, when drawing time is doubled, temperatures should be reduced by 25 deg F. For example, if the temperature is 375 F for a one-hour drawing time, it should be 350 F for two hours.

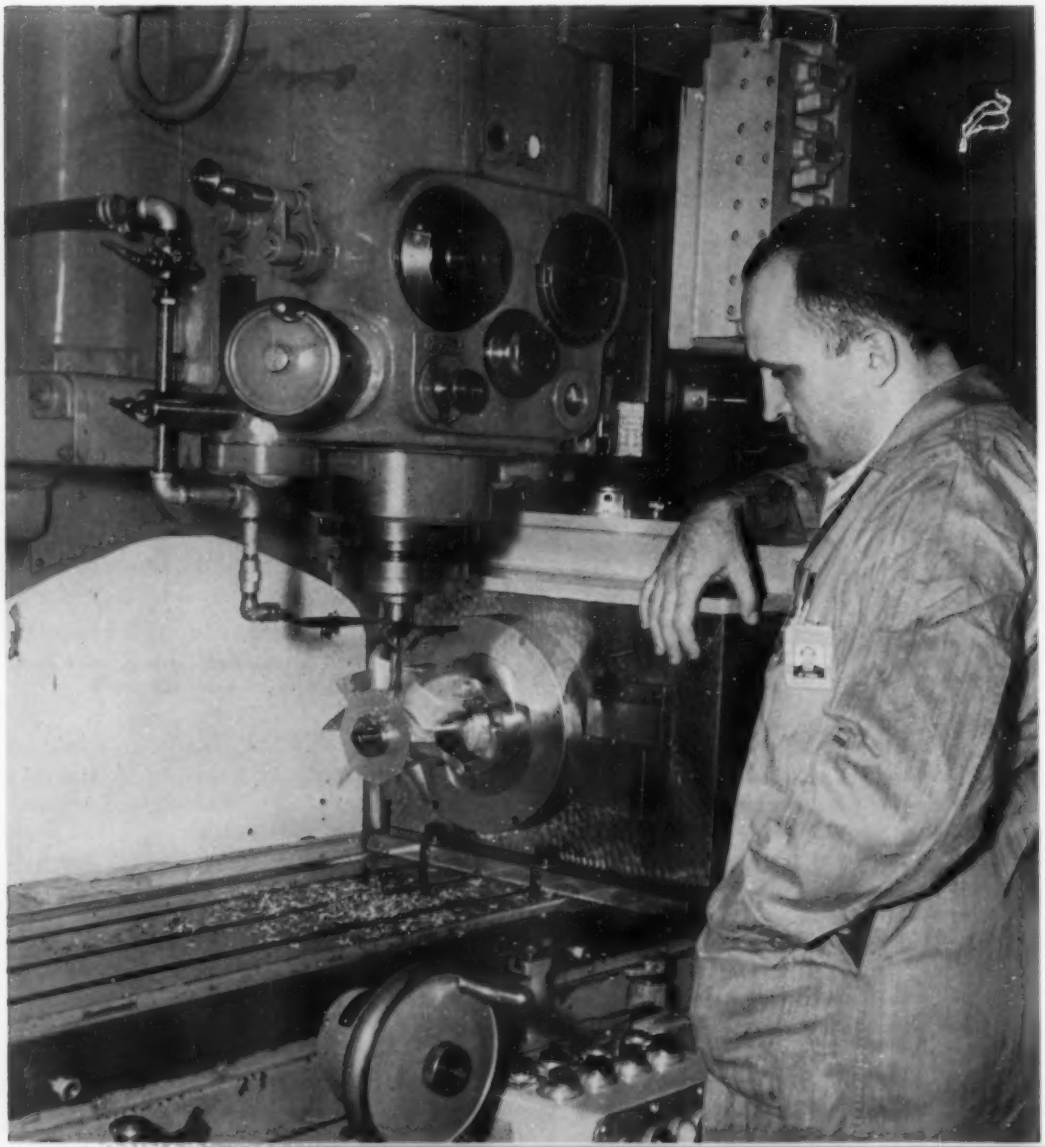
Service Failures: When a tool or die cracks or breaks after only limited service, it is nearly as costly as one that cracks in the quench. What is worse, it may leave machinery standing idle while replacement parts are being made. However, many of these failures can be prevented by observing certain precautions in grinding and stamping as well as in heat treating.

In grinding, moderate feed should be used. This will prevent grinding checks that weaken tool steel, causing it to fail in service. In some cases, grinder operations utilize an excessively heavy roughing cut and then try to remove the apparent damage with a fine finishing cut. Tool failure resulting from this practice is indicated by the way in which the edge of the fracture follows the path of one or more grinding checks.

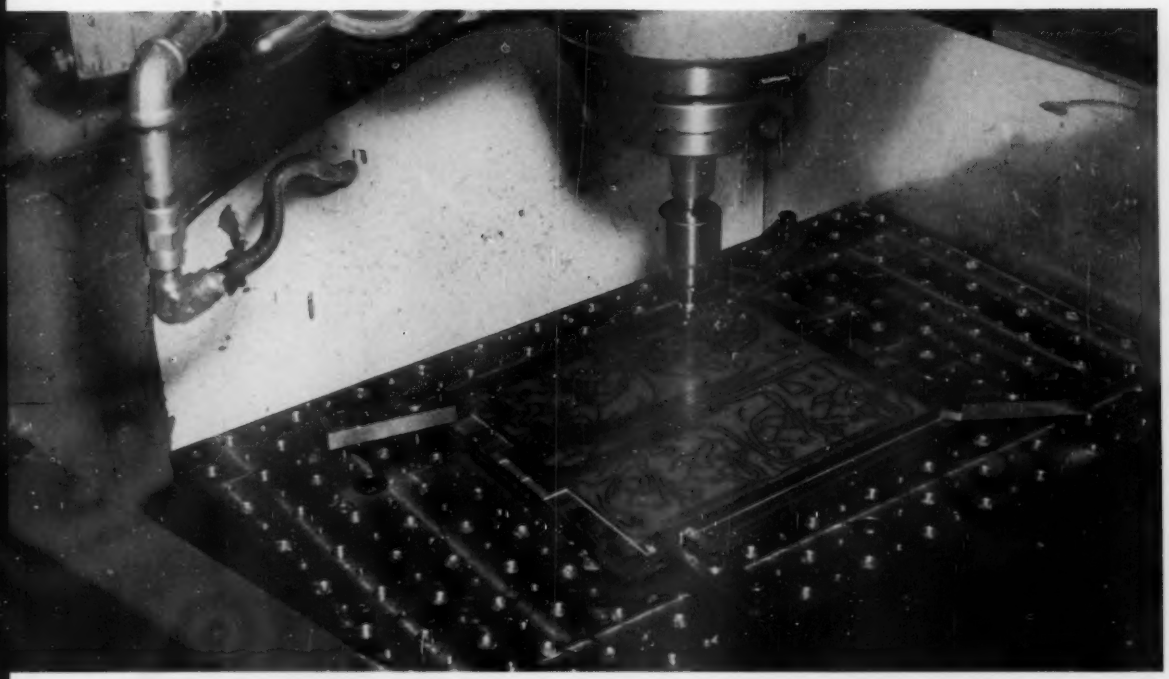
Too often it is forgotten that any noticeable line or indentation serves as a nucleus for fatigue failure, especially on shock tools. When tools are marked, they should be stamped lightly. If insufficient bark has been removed, the tool shouldn't be stamped at all. The combination of insufficient bark removal and stress concentrations resulting from stamped indentations is especially dangerous in parts which receive subsequent heat treatment.

Flush Quenching: Flush quenching of certain tools is valuable in increasing resistance to service stresses and promoting longer life from drawing, coining, striking, and header dies. Dies of this type are under heavy pressure, and are usually made from a shallow-hardening tool steel. If hardened throughout they tend to split. However, case hardening should not be too shallow or wearing surfaces will tend to cave in. In these cases, flush quenching or a higher hardening heat, or both, will drive the hardness penetration deeper.

Flush quenching is useful in increasing the effective strength of certain tools and in preventing breakage in service. When a plain carbon water-hardening tool steel is flush quenched through a cavity, the walls of the cavity cool first and contract while the rim shows little change. The outside eventually cools and shrinks, but by this time the cavity is rigid. As a result the inside is subjected to compression forces which sometimes exceed 100,000 psi. This internal compression provides a die section with the strength required to resist damage from heavy impact loads. Flush quenching is the only method whereby carbon tool steel can be strengthened for impact loads.



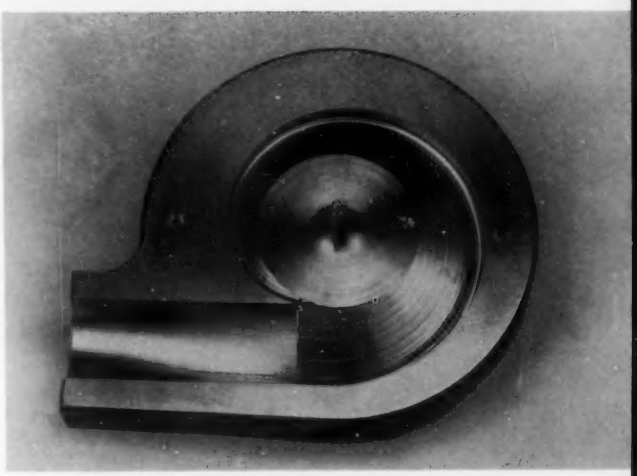
TOOLS at work



PRINTED CIRCUIT BOARDS are stacked five-high in production and drilled in about 45 minutes, or 9 minutes per board at Thompson-Ramo-Wooldridge. Drilling speed is presently limited by the maximum spindle speed of 2000 rpm. Planned acquisition of a high-speed spindle (9000-12000 rpm) will speed up the machine's production of its own electronic innards. Setup shown in photo is used for checking tapes—only one board is used to prove out tape and locating fixture.

Opposite Page—

CINCINNATI 16 x 30 Hydrotel fitted with a rotary axis produces turbine parts under control of a Thomson-Ramo-Wooldridge continuous path numerical control system. The fourth rotary axis provides the motion required to produce twist in the turbine blades. The workpiece, of aluminum, was cut in 2.5 hours, rough and finish, using a 0.625-inch end mill. Tape control enabled execution of simultaneous and proportional 4-axis movements needed to swarf cut the blade shapes. Tape instructions consist of rate commands and the ΔX, ΔY, ΔZ and $\Delta\alpha$ components.



PUMP CAVITY is machined in #340 stainless steel in 9 hours. Four different cutters are used—a ¼-inch ball end mill, ⅛-inch ball end mill, ¼-inch 135-deg drill-pointed mill and a ⅛-inch mill of similar geometry. The passage has a triangular section at the beginning of the spiral that is gradually blended to a semicircular section at the exit of the spiral. About 1.5 hours bench time is required for polishing out the tool marks shown in the photo. The workpiece is produced on the same TRW-controlled Hydrotel used to produce circuit boards and turbines, demonstrating the productivity, versatility and floor-space savings possible with numerically controlled machines.



TOOLS at work

INSPECTION of a contoured part is done on a horizontal boring, drilling and milling machine at the plant of Giddings & Lewis Machine Tool Co. The workpiece is first machined on a Numeripath-controlled contouring machine and then brought to the Numeripoint-controlled machine shown for inspection. To use the boring, drilling and milling machine for inspection, a punched tape is prepared to position the spindle at selected coordinate points across the contour of the part. Once the spindle is positioned, the operator checks tolerance with a go and not go feeler gage. Efficiency of inspection is markedly superior to previously used methods and floor-space savings are gained by using the same machine for checking as well as machining.

constant-force springs

. . . controlled force for production

By Harry E. Mankonen
Hunter Spring Co.
Div. of American Machine & Metals, Inc.
Lansdale, Pa.

Capable of supplying constant force through a virtually unlimited deflection, these springs can be used as counterbalances, motors and clamps, and for many other applications where controlled, steady force is desirable.

CONSTANT-FORCE extension springs perform a variety of mechanical functions in manufacturing, *Fig.* 1. There are three major fields of application, *Fig.* 2. First, they are used as extension springs. With the coil mounted on a freely rotating bushing, extension of the free end of the coil is opposed by the tendency of the material to return to its relaxed state. The extension spring opposes deflection with a force that is truly independent of the length of extension. The length might be a few inches or several feet.

A second use of constant-force extension springs is as motors to deliver constant torque. In this form, the spring coil is mounted on a storage bushing or take-up spool in the same manner as in the extension spring. When the free end of the band is withdrawn, however, it is wrapped in the reverse direction around a larger radius output bushing. The larger drum holds the spring material only so long as its rotation is restrained. When the output drum is released, the spring tends to recoil to its preset curvature on the take-up spool. The returning material creates a force at the periphery of the output drum and thus a moment about the drum axis.

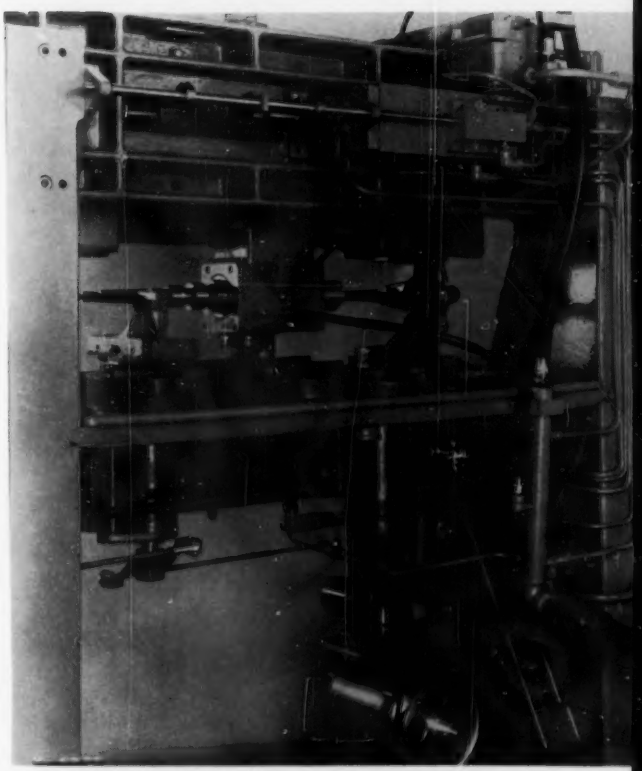


Fig. 1. Pratt & Whitney-designed device utilizes constant-force extension springs to maintain belt tension on a turbine-blade grinder. The springs partially counterbalance the weight of motor and base assembly below the machine table.

This output torque is independent of deflection. The number of turns can vary from one to thirty or more.

As a clamp, the spring operates in a manner similar to the extension spring. Both ends of the material are allowed to coil separately to develop a clamping pressure between them. The possible opening or distance between the coil heads is limited only by the length of material used to make the

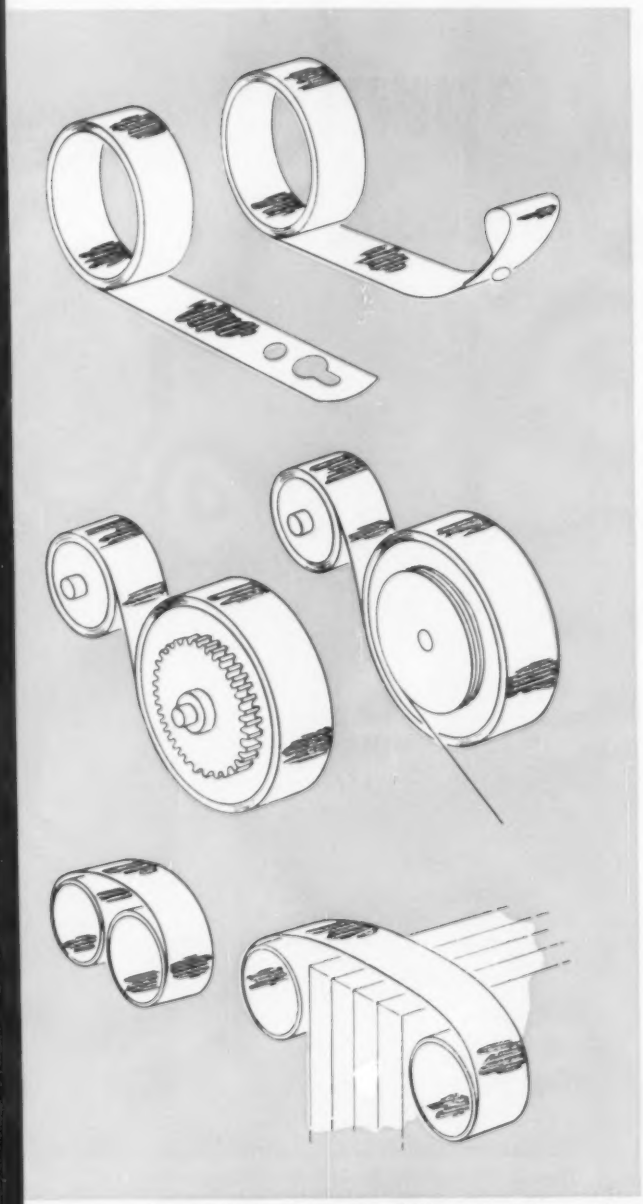


Fig. 2. The three forms in which constant-force springs are used: as extension spring (top); as motor (middle); as clamp (bottom).

spring. Clamping pressure remains constant, and is completely independent of the width of the opening between the jaws formed by the two coils.

Among the first machine-tool applications of constant-force springs was their use as direct counterbalances. An ingenious example of this application is shown in *Fig.* 1. Here a constant tension of 10 lb on the belt of a turbine-blade grinder is provided by two extension springs that counterbalance 50 lb of the 60-lb weight of the grinder's motor and base assembly. The resulting 10-lb constant belt tension insures satisfactory tracking of the belt on the contact wheel.

The motor and base assembly are mounted on the bottom end of a piston that is free to slide vertically in a cylinder. The two constant-force springs, each exerting a 25-lb force, are rolled on bushings mounted on the piston frame and their extended ends are secured to the top of the base assembly. A dead-weight counterbalancing system would not be satisfactory in this application since the entire grinding-belt assembly has to be rotated about its vertical axis in order to maintain the grinding pattern.

Another manufacturing application of the constant-force extension spring is its use to exert constant-ratio cam pressure in a manual contour wheel dresser, *Fig.* 3. This dresser has a compact ratio mechanism for precise 5:1 reduction from template to grinding wheel contour. Maximum travel of 18 inches by the template slide is reduced to 3-inch movement of the diamond slide by means of a feed cam and feed cam quadrant, *Fig.* 4. To insure that the feed cam quadrant follows the feed cam accurately at all times, two counteracting zero-gradient constant-force springs produce a constant pressure at the feed cam surface at all positions of the template and diamond slides.

The machinist operates the dresser by moving the template slide back and forth with his right hand on the knob at the rear of the slide and by adjusting the arrow-shaped follower (which transmits vertical motion) on the template contour with his left hand on a second knob.

The coil of one spring is mounted on a stationary bushing and its outer end is secured to the diamond slide containing the feed cam quadrant. This spring, actually consisting of two identical constant-force springs coiled together, exerts a total constant force of 9 lb toward the feed cam.

To provide an equal and opposing force at any position of the manually operated template slide, the other spring loads the feed cam with a constant force of 1.10 lb. The coil of the second spring is mounted on a stationary bushing and its other end is attached to the sliding member. Although a one-directional force on the feed cam by only one spring would insure proper following, opposing forces are necessary so that the slides will remain in position when not being operated.

In motor form, constant-force springs are ideal for maintaining tension, retrieving reeled-out material and counterbalancing objects through long deflections. Reels powered by constant-force springs can provide much greater deflection—without gearing—than conventional springs.

Constant-torque spring motors are used to retract the instrument cable of a displacement trans-

ducer, *Fig.* 5. This transducer measures the deflection of structural members during dynamic load tests. When the transducer's steel cable is extended by the deflection of a structural member, it turns the reel on which the cable is wound. Rotating with the reel is the wiper arm of a ten-turn potentiometer, which measures the displacement electrically. Four spring motors provide restraining torque on the reel, keeping the cable taut with a constant force of 1 lb. As the load is removed, the spring motors rewind the cable.

An advantage of the constant-torque spring motors is that the reel of the displacement transducer is capable of 10 turns without any build-up of the restraining force. With one rotation of the reel equal to one foot of cable extension, up to 10-foot deflections can be measured. Were a conventional spring motor used, force build-up would be considerable and would probably inhibit the response of the potentiometer, thus distorting both the amplitude and frequency of displacement of the member being tested. The constant-torque motors eliminate backlash, as well.

A constant-force spring, in the form of a "toothless rack" simplifies the construction and smooths the operation of a test instrument, *Fig.* 6. Rotary motion of the gage control knob is converted into unidirectional linear motion at the gage head through a one-piece prestressed coiled band instead of the usual geared rack-and-pinion. This design

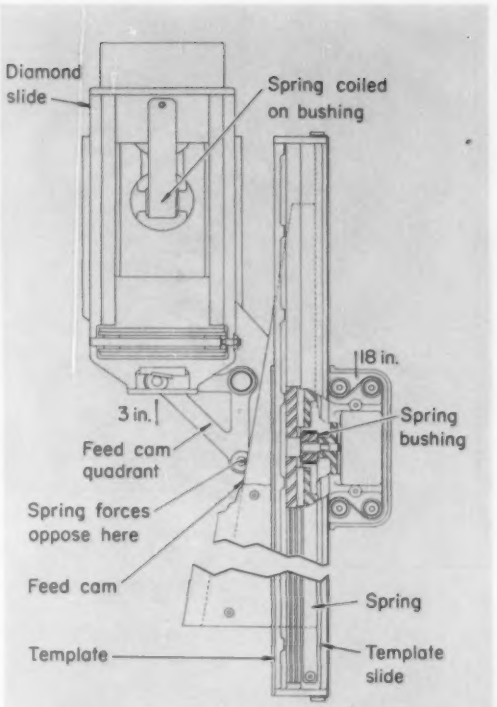
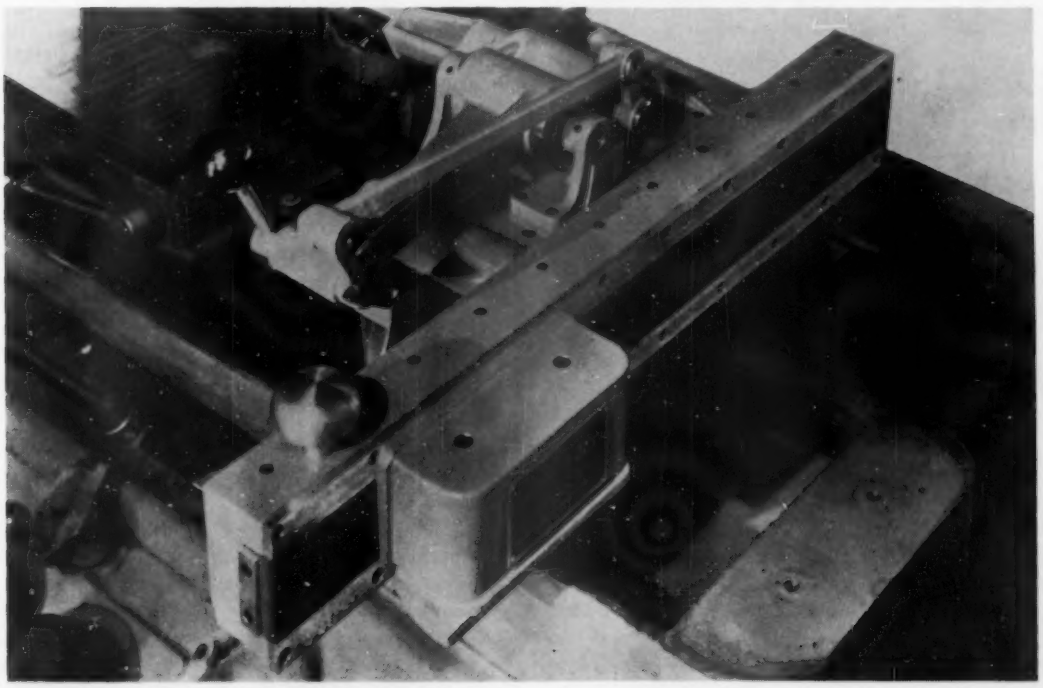


Fig. 4. Detailed design of wheel dresser illustrated in photograph below.

Fig. 3. Two constant-force extension springs insure that feed cam quadrant follows feed cam on this Hoglund manual contour wheel dresser.



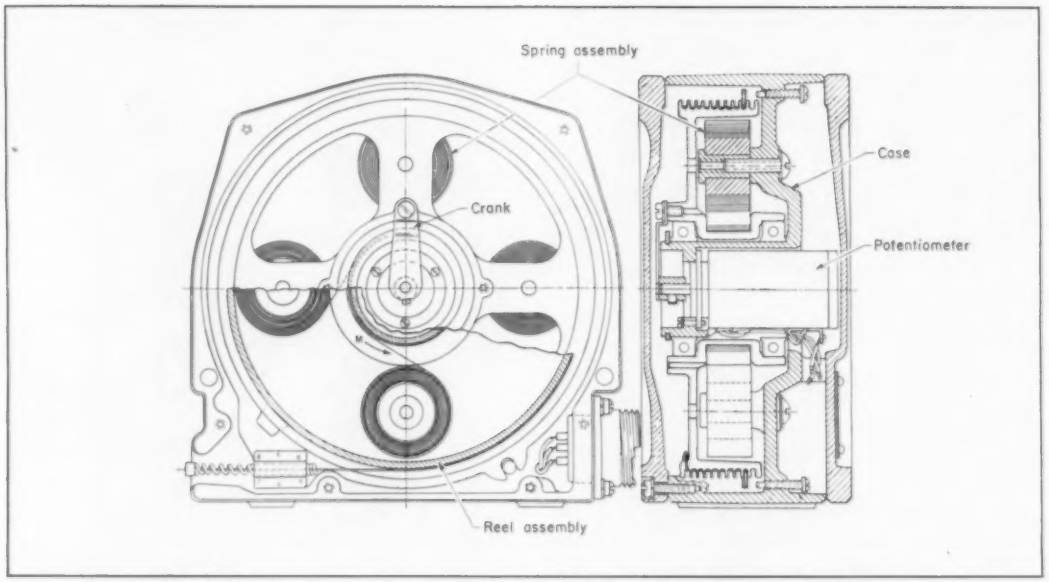


Fig. 5. Constant-torque springs retract the cable of a displacement transducer.

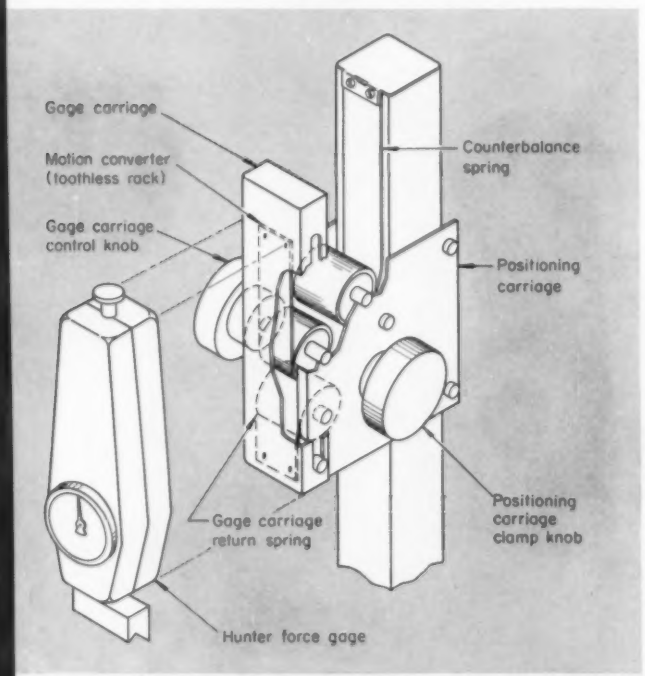


Fig. 6. Constant-force spring serves as "toothless rack" in construction of a gaging instrument.

eliminates the need for machined parts and provides smooth operation.

The force exerted by the spring is minimal—only enough to cause it to coil itself naturally, thus keeping its extended end taut, eliminating play and backlash. The spring links the manually operated control knob with the gage carriage. Its coil is drum mounted on the stationary positioning carriage and its extended end is secured to the movable gage carriage. When the control knob is turned clockwise it winds up the extended end of the spring to pull the gage and its carriage downward as required by the test procedure. Total linear travel of the toothless rack is two inches—all that is needed in the tester. Much longer one-way travel is possible.

The toothless rack is irreversible and is used only to advance the gage against the part being tested. It is returned to the raised position automatically, when the control knob is released, by a second constant-force spring, which is mounted in opposition to the first spring. This second spring exerts a constant 2-lb force to raise and support the gage and its sliding carriage without offering significant resistance to manual operation of the control knob.

A third constant-force spring counterbalances all moving components of the tester. Its coil is mounted on the positioning carriage, which is adjustable at any height on the column. The extended end of the spring is secured near the top of the post. Normally, the positioning carriage is held in place by a friction lock engaged by the locking knob. If it is not, the third spring will slightly overbalance the positioning carriage—and the gage and gage carriage that are mounted on it—causing the entire assembly to rise slowly to the top of the column.

These applications illustrate only a few of the uses of constant-force springs in manufacturing and inspection. There are potential applications in almost every manufacturing plant. The ability to apply constant spring force solves many design and production problems.

SOLDERING ALUMINUM

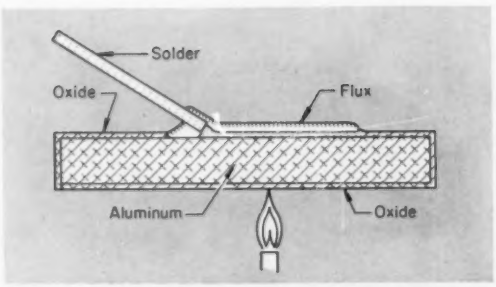


Fig. 1. Removing aluminum oxide by fluxing. Chemical action of the flux removes the oxide.

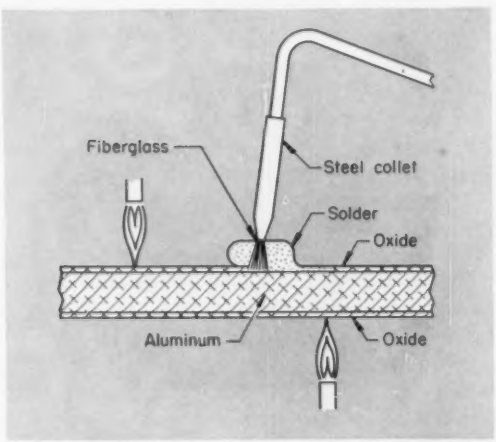


Fig. 2. Abrasive removal of oxide. Brushing action abrades oxide from the aluminum surface, allowing solder to tin the surface.

SOLDERING is a convenient and low-cost means of bonding aluminum, readily performed by semi-skilled personnel and resembles soldering most common metals with a few differences. Most important is that an oxide forms on an aluminum surface as soon as it is exposed to air. Three major types of methods exist to remove the oxide for successful tinning operations. Flux soldering, *Fig.* 1, uses a chemical action to remove oxide. Friction soldering as shown in *Fig.* 2 removes the oxide by abrasive action. Ultrasonic soldering, *Fig.* 3, utilizes cavitation produced in the molten solder pool to break up the oxide film.

Available solders are indicated in TABLE 1. Of the low-temperature solders, the best is a tin-zinc eutectic containing 91 percent tin and 9 percent zinc. The solder melts at about 400 F, wets aluminum readily, flows easily and resists corrosion well. Low-temperature solder enables minimum loss of strength and hardness and minimum warpage, particularly important in large complex shapes. Intermediate-temperature solders wet aluminum more readily than the low-temperature solders, form larger fillets, and produce stronger and more corrosive resistant joints than the low-temperature solders. The high-temperature solders contain from 90 to 100 percent zinc, are the strongest and cheapest of all aluminum solders, and resist corrosion better than low and intermediate-temperature solders.

From "Soldering Aluminum," by Charles Bruno, Reynolds Metals Co., Richmond, Va.

Table 1—Aluminum Solder Characteristics

Solder Type	Melting Range (deg F)	Common Constituents	Ease of Application	Wetting of Aluminum	Joint Strength	Corrosion Resistance	Effect on Aluminum
Low melting point	300-500	Cadmium Tin Bismuth Lead Zinc	Best	Poor to Fair	Low	Low	Negligible
Intermediate melting point	500-700	Cadmium Tin Zinc	Moderate	Good to Excellent	Moderate	Moderate	Moderate
Hight melting point	700-800	Zinc Tin Aluminum Copper	Most Difficult	Good to Excellent	High	Good	Reduces strength at joint

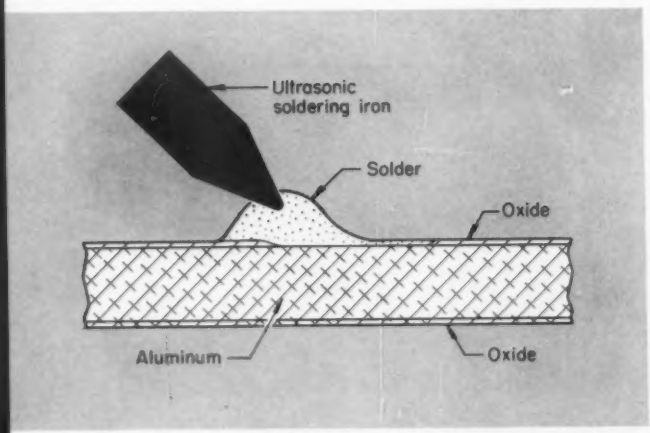


Fig. 3. Ultrasonic soldering. Ultrasonic waves cause cavitation, breaking up the oxide and floating it to the top of the solder puddle.

Methods of soldering aluminum are indicated in TABLE 2. When flux is used, remove all traces of the flux, as it is corrosive. High heat output is required (several times as much as for steel) because of aluminum's thermal conductivity. Flames should not be directed against the immediate joint area. Parts must be designed for a snug fit—aluminum usually requires a 0.030 to 0.035-inch clearance for adequate flow of solder into the joint.

Table 2—Methods of Soldering

Solder Application Technique	Recommended Oxide Removal Method
Soldering Iron	Flux or Friction
Soldering Flame	Flux or Friction
Hot Plate	Flux or Friction
Dip Soldering	Flux only
Furnace Soldering	Flux only
Ultrasonic Soldering	Friction only
Dip bath with special abrading mechanism	Friction only

In fluxless or friction soldering, solder can be applied by vigorously rubbing the solder stick over the area to be tinned. As the oxide film is removed by abrasion, the solder wets the area. Other methods of abrading oxide from the surface can be used such as a wire brush, hack-saw blade, mill file, soldering iron point, steel wool, fiberglass brush, and grinding wheel. A medium grit grinding wheel can be loaded with soft solder, and the aluminum wetted by simply abrading its surface with the loaded grinding wheel. This method of tinning also works with glass, titanium, molybdenum, tantalum, ceramics and cobalt. When the fiberglass brush is used, solder is melted to form a pool and a light brushing action of the fiberglass brush removes oxide from the work surface. After the parts have been tinned, they are assembled, clamped and the joint filleted by heat and the brushing action. In ultrasonic soldering a frequency of 20 kc is often used as it is not noticed by most humans, but causes active cavitation. The ultrasonic technique works satisfactorily for anodized, alodized, or irridized aluminum surfaces.

Performance of soldered aluminum joints is good for electrical and thermal conductivity, and sealing. Mechanical strength is essentially the same as solder joints in other metals, the actual joint strength depending primarily on design of the joint and composition of the solder. Corrosion in a soldered joint can be either chemical or galvanic. In either case, moisture is essential for corrosive action. Thus by avoiding moist environments or by protecting the soldered joint with a waterproof coating, moisture penetration is eliminated and the joint remains free of corrosion.

efficiency *in action*

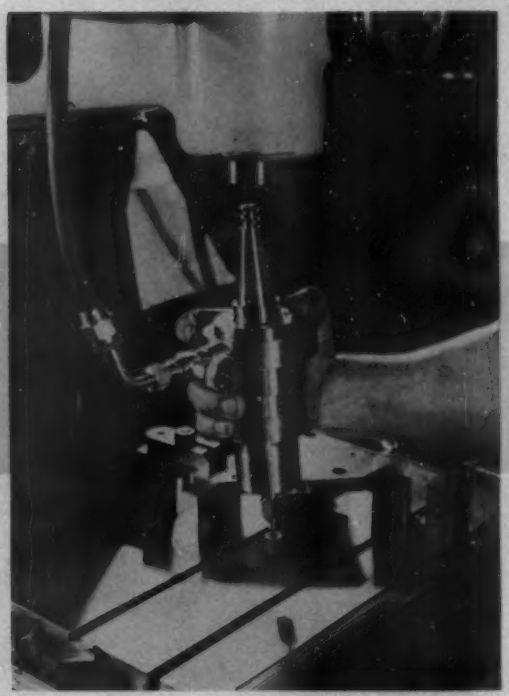
...a pictorial preview of the 1960 WESTERN TOOL SHOW

124 Grinding and Finishing
126 Holemaking, Hole Finishing
129 Hydraulics and Pneumatics
130 Machine Accessories
131 Measurement and Inspection
133 Milling
134 Pressworking
135 Shop Equipment
136 Turning
138 Workholders, Jigs, Fixtures

Representative machines and tools to be shown at the ASTME Western Tool Show in Los Angeles, Nov. 14-18, illustrate how manufacturing efficiency is the key to American industrial progress.

grinding and finishing

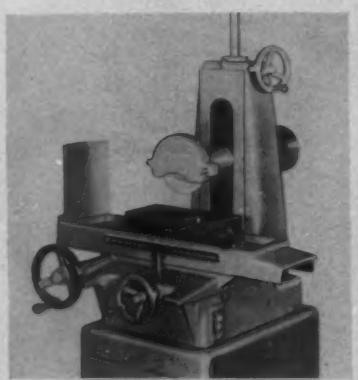
Improved machines and new processes have increased productivity and accuracy in the field of finishing.



Used for small-hole drilling, contour milling, form duplicating, cam grinding, jig grinding and production setups, the Vulcanaire jig grinder produces a 6 to 8-microinch finish, using carbide burrs or mounted points. The grinder is available in two series: one grinds 1/16 to 1¾-inch holes and the other, 1¾ to 4-inch holes. Frank Loy & Associates.



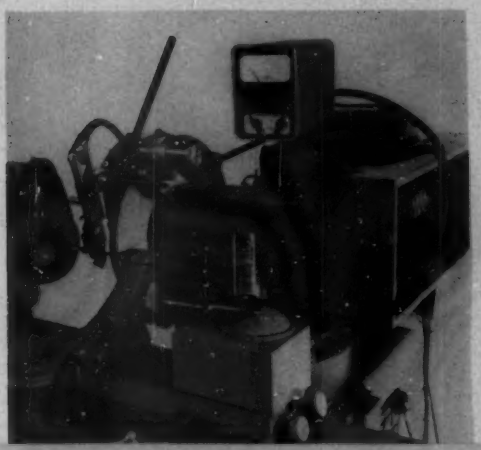
Syntron Co.s Model VN-23 vibratory barrel tumbling machine has a screen cover and hose connection for flushing out compounds and a screen trough to separate the parts and media. The amplitude of vibration can be varied from low to high by turning the rheostat knob on the control box. Barrel capacity is 1 cu ft and load limit 100 lb.



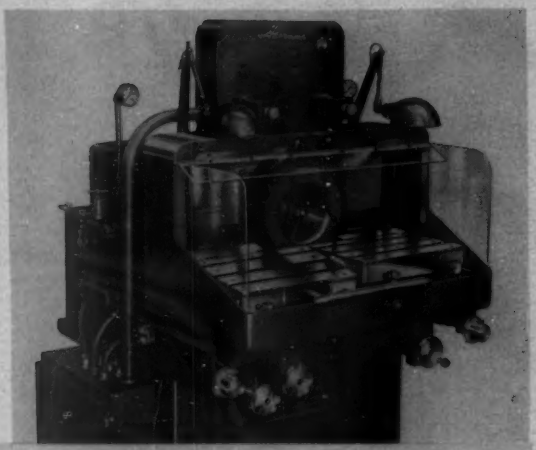
Equipped with a direct drive spindle, this Harig No. 612 surface grinder has an automatic system that lubricates the entire machine. Right or left-hand longitudinal feed is available. Bell Machinery Co.



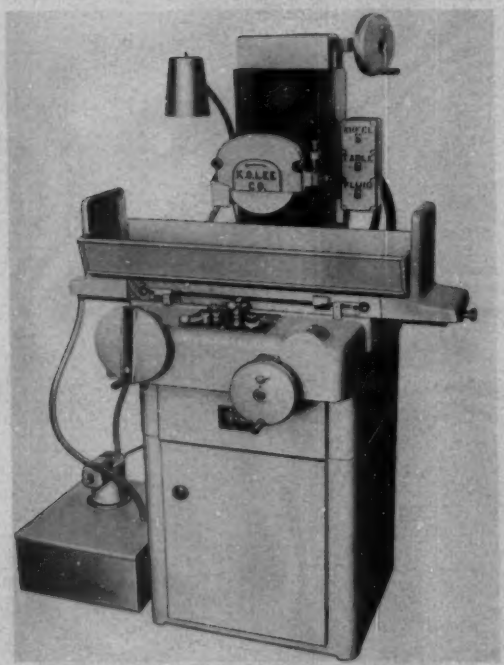
Hydraulically operated, this No. 1300 EIU cylindrical and internal grinder has a wheelhead that can be swiveled through 180 deg and that carries an external grinding wheel and an internal grinding spindle. The 120-psi hydraulic system permits shockless table reversal at all speeds, with infinitely variable 3 to 144 ipm table traverse and a 0.040-inch minimum stroke. Micromatic Hone Corp.



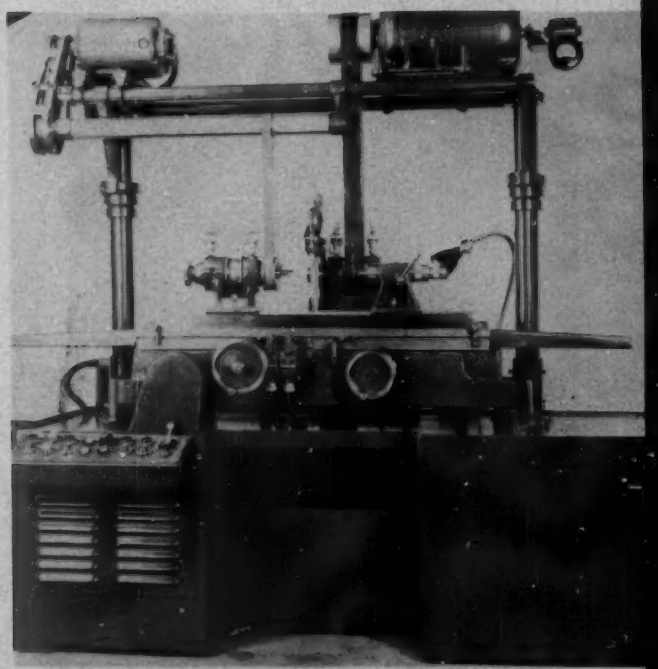
After a 3-minute setup, no adjustments are necessary on this Model L-2Q Autopairer throughout the entire production run, regardless of wheel wear or dressing. An IG type internal gagehead automatically varies grinder reactions according to individual bore diameters. The electronic dial gage indicates roundness, finish and taper. Electro-Autosizing Machine Corp.



This Model EGD-12 electrolytic oscillating grinder with duplex tables utilizes the electrochemical method of stock removal. The machine, made by Hammond Machinery Builders, Inc., allows 80 to 90 percent savings in grinding wheel consumption, speeds up tool-grinding production and eliminates cracking of the tool.



Available in units for either wet or dry grinding, K. O. Lee Co.'s No. S612H hydraulic surface grinder has a table working surface of 14 x 6 inches with a 7/16-inch-wide T-slot. Longitudinal table travel is 14 inches and crossfeed travel, 7½ inches. The 7-inch-diam grinding wheel has a thickness of 0 to ½ inch and a hole diameter of 1¼ inch. The spindle is driven with an O-ring type belt at 3450 rpm. Accessories for the grinder include a magnetic chuck and diamond dresser.



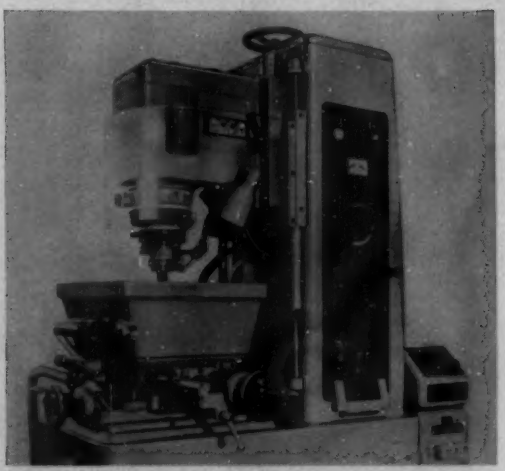
This Crystal Lake No. 1020 grinder has a 12-inch wheel mounted on a double-taper spindle and a 2-hp d-c motor with a spring mounting to remove d-c ripple. The belt is driven at a 90-deg angle from grinding wheel bearing pressure. The wheel will rough grind at 6500 fpm and, if the rheostat is turned, will finish grind a roll at 4000 fpm. The grinder has a 20-inch distance between centers, an 8-inch swing over standard water guards and a 42-inch table. Bell Machinery Co., Inc.

holemaking, hole finishing

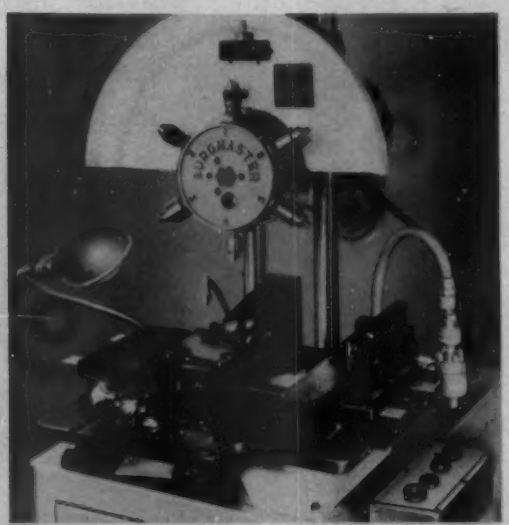
Higher precision, higher speed and better tool life are the benefits made possible by these machines.



This Hughes N C 205 numerical control system positions a two-axis table and the depth on a third axis of movement from a punched tape. The transistorized all-electronic system permits the amount of movement for each drilling, boring or tapping operation to be tape programmed without setting limit stops. Holes of various depths and at various levels can be drilled with the same spindle and depth accuracy can be held to within 0.001 inch.



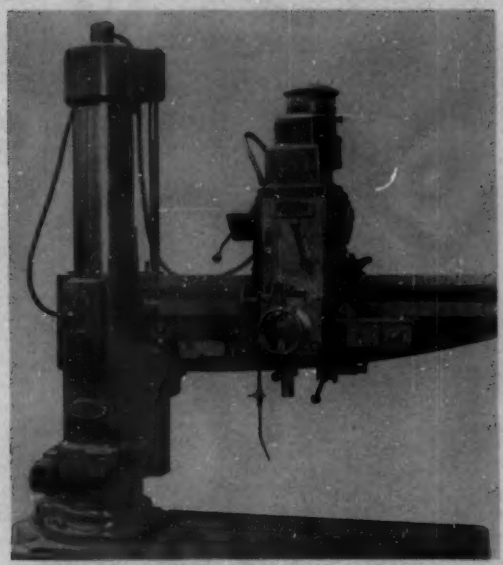
Based on the principle of machining metal of all hardnesses by electroerosion, the Eleroda D1 sparking machine tool can be used for drilling, piercing, profiling and cutting operations. Machining is accomplished by a tool electrode, the shape of which is reproduced in the workpiece. Operating on a simple electrical circuit, the high-precision machine contains no electronic parts. It is built by Charmilles Engineering Works, Ltd.



Work is rapidly positioned by a ball-bearing mounted table on this 6-spindle Burgmaster turret drilling and tapping machine. Positioning to an accuracy of ±0.0005 inch is accomplished by depressing a thumb button on the positioning handle and shifting the table. Releasing the button locks the table in accurate location by dropping an air-operated shot pin into a master template with the required hole pattern. Marshall Tool & Supply Co.



This No. 300 peck drilling unit is designed to operate as a machine tool component for drilling long holes through a step-and-repeat action. It drills long oil passage holes in crankshafts and performs similar operations that require removal of the drill from the work to clear the tool of chips. The self-contained unit has a variable feed rate of 0 to 90 ipm, a variable stroke of 0 to 12 inches and spindle speeds to 10,000 rpm. Drillunit, Inc.



This NLD light duty radial drill has two flat runways on top of the arm and a head that balances and moves on four roller bearings along the top of the arm. The head mounting facilitates positioning with no wear or drag of the head on the arm. A solid nonsplit casting with a large bearing on a nonrotating column, the arm rotates on the column on roller bearings. The drill thrust is taken by the front lower dovetail and directly behind the spindle. In operation, the machine, made by Associated Machine Tool Corp., is clamped by one lever in conjunction with electromechanical clamping.



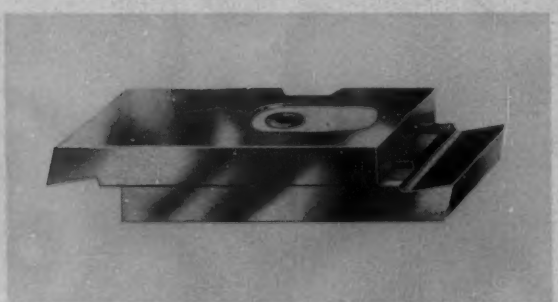
The highly sensitive hand feed of this Stanley drill adapter permits delicate drilling. The tool, made by Frank Loy & Associates, allows pilot holes to be drilled or tiny holes production drilled, even with large equipment.



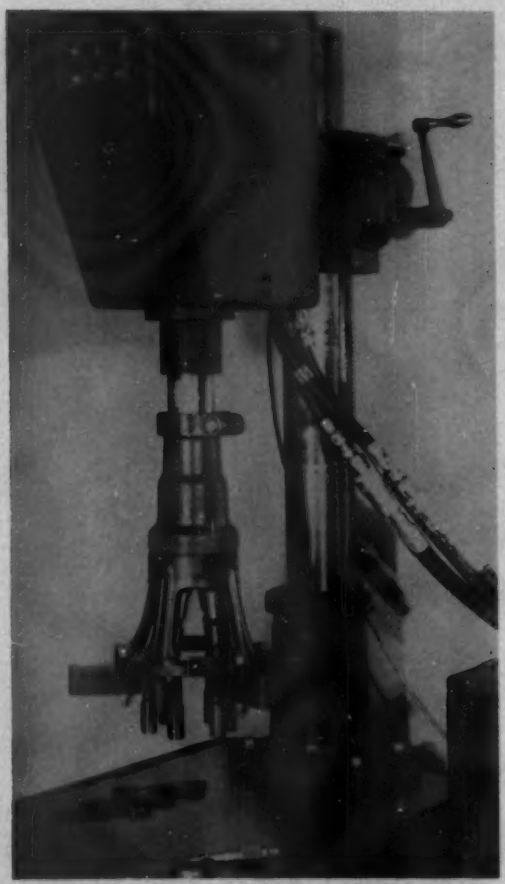
Handwheel control on the drive shaft of this portable honing cylinder permits stone cutting pressure to be maintained or increased without interrupting the honing operation. The units available cover bore diameters from 2¾ to 28 inches. Drive shaft extensions can be added. Sunnen Products Co.



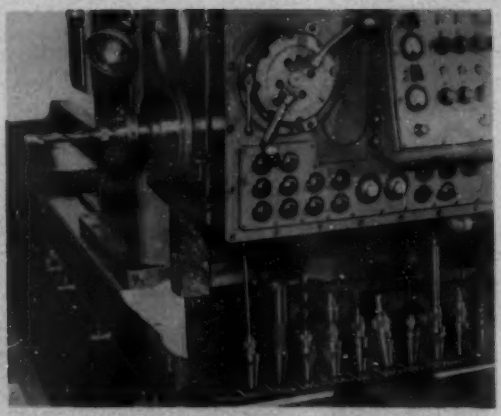
Suitable for tapping in all materials and for high-precision work, the tapping attachment on this drill press has a capacity range from 0 to ½ inch. The attachment is available in two models: one that fits into the drill press chuck and another that attaches directly to a No. 2 Morse taper spindle. Supreme Products Corp.



After a normal amount of cutter life, the cutter blades on this floating reamer can be extended for an equal amount of additional life. The tool, manufactured by Madison Industries, has an on-center construction with mating parts that slide on V and flat surfaces to eliminate any scissoring action. The cutter is adjusted to size while it remains in the bar. Tolerances can be held to 0.0005 inch and the finish produced is from 50 to 100-microinch rms, depending on feed, speed and material.



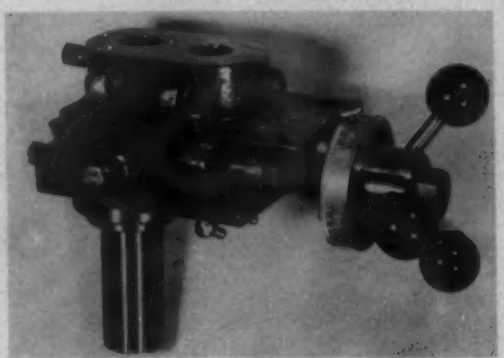
Equipped with a single leadscrew, torque control, six spindle speeds in geometric progression from 167 to 1020 rpm and a 2¾-inch-diam quill with a stroke adjustable from ¼ to 4 inches, this Model T-300 tapping machine requires only an 18 x 24-inch table area. Milman Engineering Co.



Mounted in the spindle of this Kaukauna tape-controlled machine is a Kwiklok quick-change toolholder. Kwiklok adapters are also installed on the machine. This line of tooling permits tool changing in 2 to 3 seconds and is commonly used on tape-controlled machines. Falcon Tool Co.



Equipped with independent variable speed controls for both the headstock and drilling spindles, this Model ACDO drilling machine cuts holes as small as 0.0006 inch. To clear the chips, the drill can be withdrawn and returned to cutting position without striking the bottom. Louis Levin & Son, Inc.



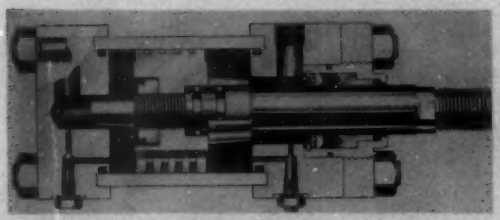
Providing adjustable setup for rough and finish boring operations, this vertical slide tool is also used to produce recesses and grooves. It is available in shank type or flanged mounted models. Exward Andrews Tools & Machinery Co.



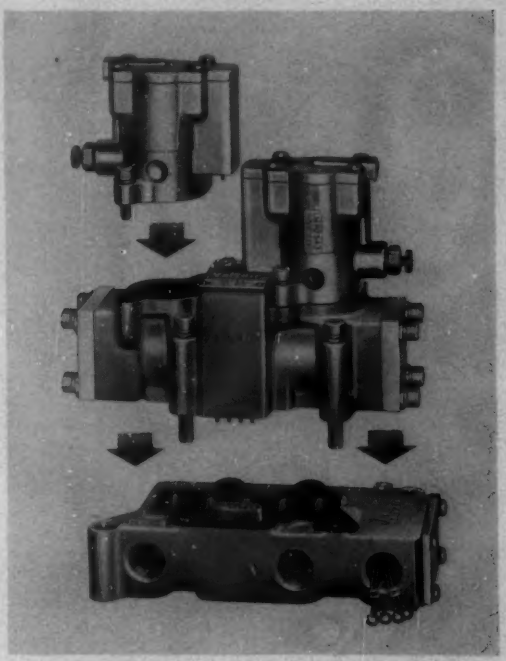
Self-centering and double-jointed, this drill press can tap and drill two parts at once, with no moving of the parts required. The press covers a 41-inch-diam workpiece or drills to the center of a 90-inch-diam workpiece. Garland Tool & Mfg. Co.

hydraulics and pneumatics

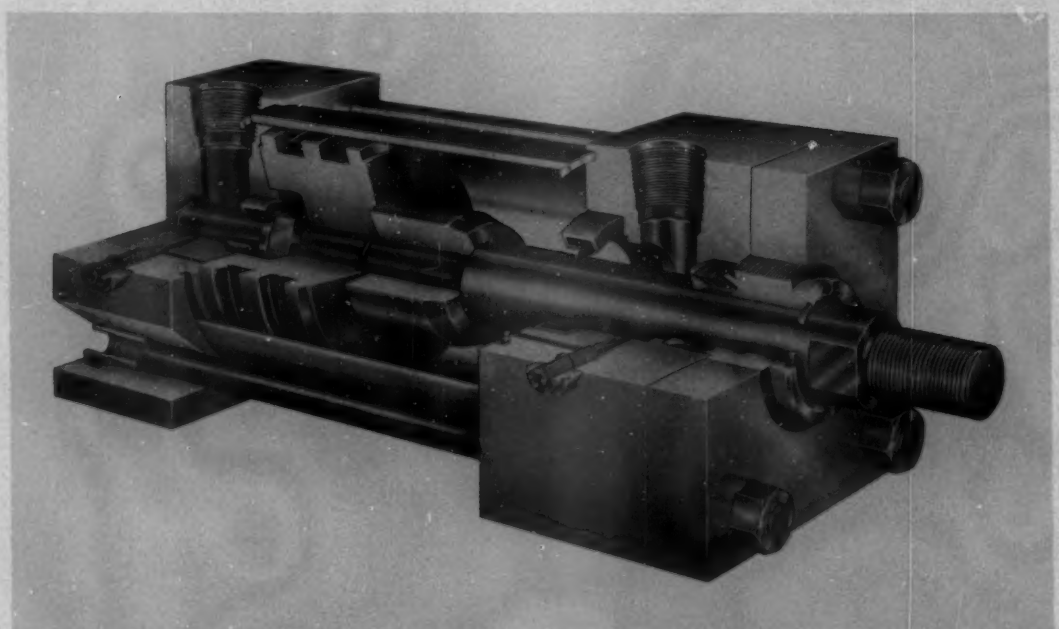
Hydraulic and pneumatic controls automate many manufacturing processes.



Designed by Carter Controls, Inc., to meet JIC standards for interchangeability, this square-line hydraulic cylinder has a removable cartridge rod bearing. A metal rod scraper and a rubber rod wiper protect the cylinder against chips and dirt. High side loads, which can cause excessive rod bearing wear, are compensated for by a self-centering floating cushion that can concentrically align itself with the cushion cavity in the front head.



Bellows-Valvair ½-inch valves are equipped with built-in plugs and connectors in the pilot, main valve body and sub-base or with manifold complete air and electrical connections when the valve and pilot are plugged in and bolted down. Built to JIC standards, the valves have universal pilots with multimillion cycle life. Pressure is from 0 to 300 psi. Valves of ¼-inch size are also available.



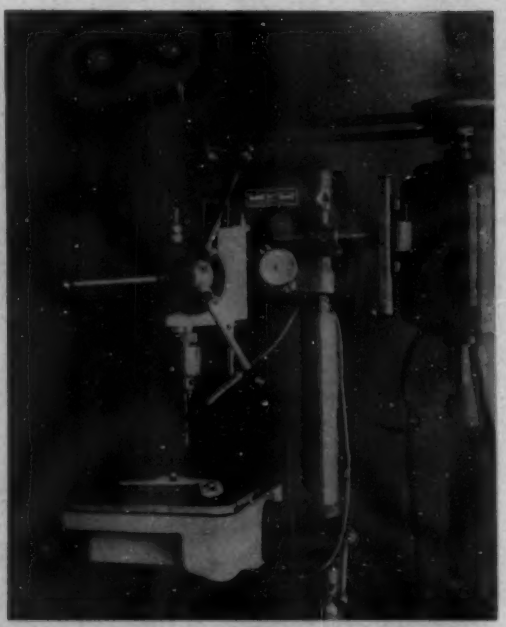
Tomkins-Johnson's square head cylinder is available in standard bore diameters from 1½ inches to 8 inches. It has leak-proof cylinder head to body construction, using gasket type seal; minimum centerline-to-centerline mounting; interchangeability with other standard JIC cylinders; and controlled packing compression. It is adaptable to the use of low-pressure oil as the working medium.

machine accessories

Ingenious and useful accessories are adding new efficiency to machining.



Zero-Max Co.'s No. 400 fractional horsepower variable speed drive takes any one speed at the input shaft and delivers stepless variable speeds from the output shaft. If the load greatly exceeds the torque rating, the output shaft is disconnected, then reconnected when torque is reduced.



Used on a standard drill press, this Drillco table with mist attachment and interchangeable T-slotted top plate serves as a coolant table with a tank.



These flat self-guiding vernier scales eliminate parallax and distortion as well as problems due to backlash, leadscrew wear and miscount of turns. Edgcomb Engineering & Engraving Co.

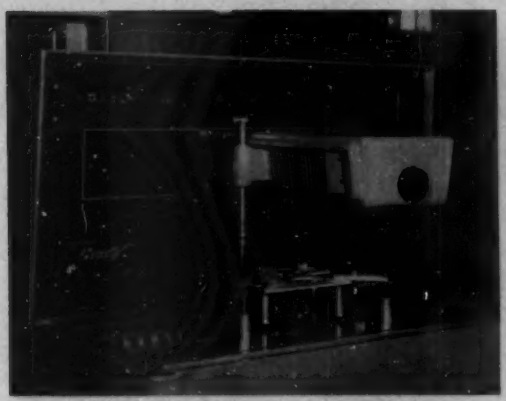


These Graymills coolant systems deliver coolant or heavy cutting oils to 500 SSU. Model H-2-33JL (¼ hp) has a 10-gal tank and Models H-1-37JL (¼ hp) and H-1-46DL (⅓ hp) have 38-gal tanks.

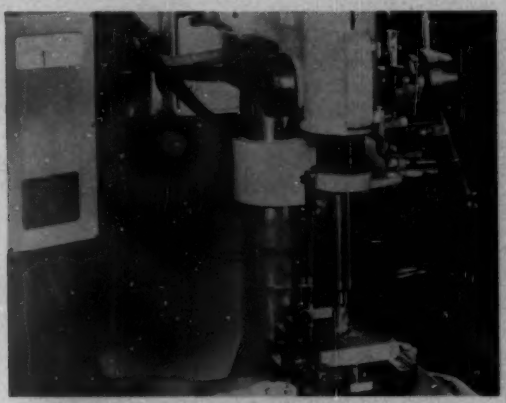


Used primarily on jobs that circulate coolant liquids containing grit and abrasives, this rectangular pump system, Model WP 1021, has a 1/20-hp, 115-v, 60-cycle motor and a 12-gal, 24 x 12-inch tank. The round unit, Model WP 521, is equipped with carrying handles, a removable inner container and a 5-gal 12-inch-diam tank. Wesco Tool, Inc.

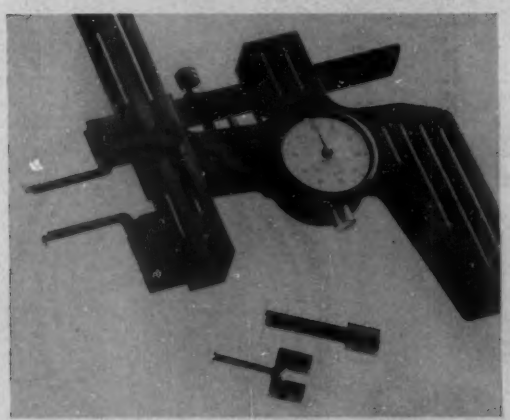
Gages, comparators, torque testers, inspection machines—all are capable of greater accuracy and repeatibility than were possible formerly.



A system of direct and continuous-reading position indicators make Bendix's FI-22 coordinate inspection machine capable of simultaneously inspecting both *X* and *Y* displacements to an accuracy of 0.001 inch. The machine's floating zero and bidirectional position readouts keep setup time to a minimum. Probe tips permit inspection at any hole location.



B. C. Ames Co.'s No. AG 5 air gage can be used to control the depth of a precision counterbore in a plastic pump housing to a tolerance of 0.0005 inch. The gage has 0.000050-inch graduations and a 0.002-inch range full scale. Air coming from the nozzle tip keeps the zero surface of the jig free from dirt and chips. Almquist Tool and Equipment Co.

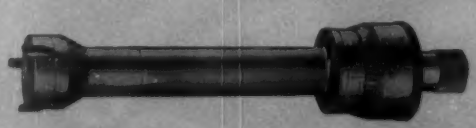


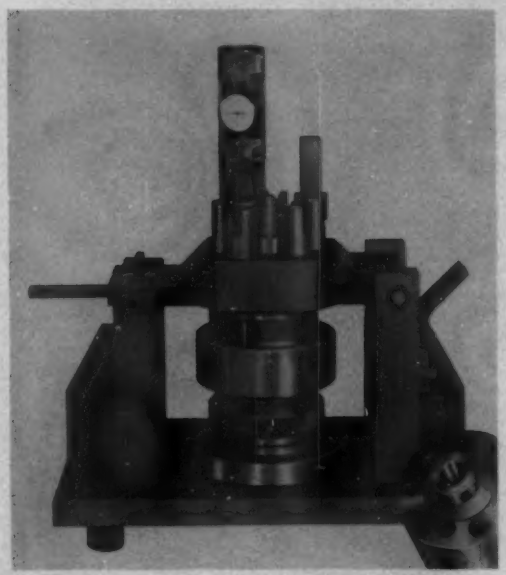
This Mueller groove gage can measure inside and outside O-rings, snap rings and various sizes of undercuts. It has an inside measuring range of 7/16 to 6 7/8 inches. By reversing the slide, the gage measures outside diameters up to 3 1/8 inches. The instrument is available in 12-inch models.



Suited for the checking of power tools equipped with torque control clutches, this Scully-Jones dynamic torque tester can also be used for testing hand-operated torque control tools. It detects any variation from the predetermined correct torque output with an accuracy of ± 3 percent.

Specially designed contact points on Lufkin Rule Co.'s 600 C12 micrometer hole gage permit the taking of measurements at the bottom of holes. The irregular arrangement of three anvils around the head of the gage—135, 135 and 90 deg—helps in detecting the geometric error in out-of-round holes.

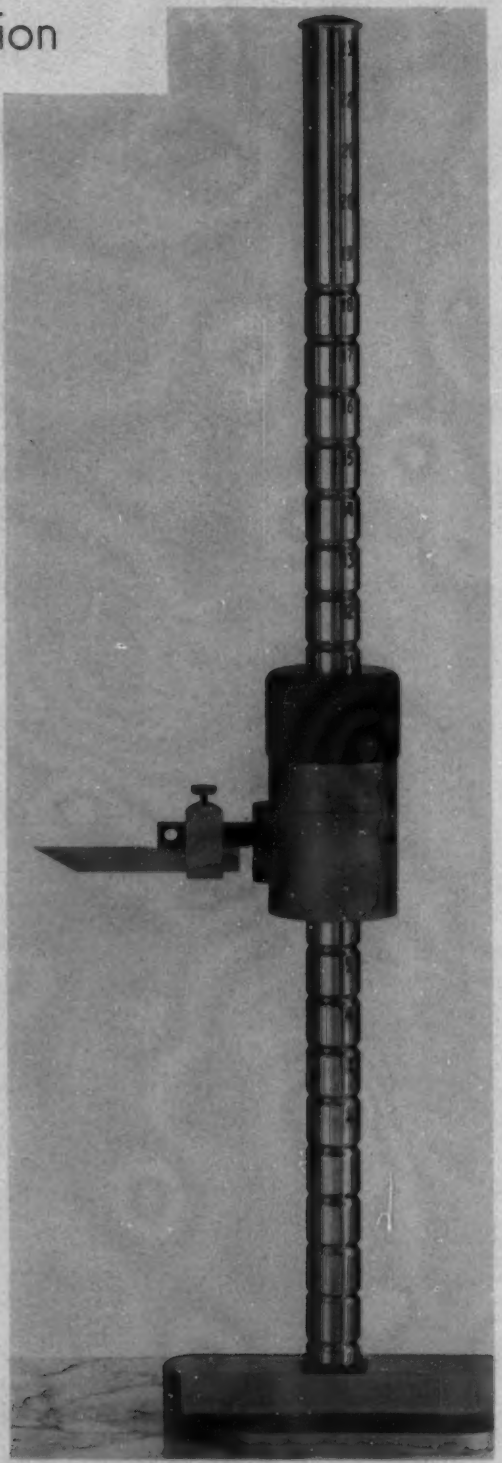




Mayes Tool Co.'s No. CC-100 gage is used to check holes for concentricity and location. The indicator is read in one position. The pilot is stationary.

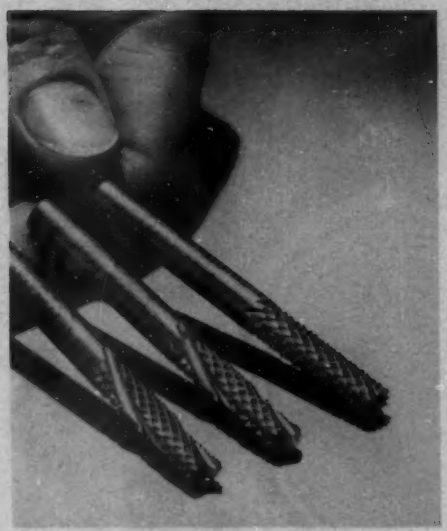


Eliminating gears, racks, pinions and friction bearings of any kind, this Mueller Mikrom comparator affords frictionless amplification of perfect repeating accuracy. Interchangeable heads for the stand are available in the following graduations: 0.0001, 0.00005, 0.00002 and 0.00001-inch.

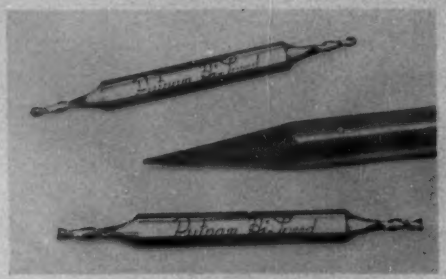


Intended for use in inspection, precision layout work and checking jigs and fixtures, this Heightmaster gage, manufactured by United States Chemical Milling Corp., gives accurate measurements to 0.0001 inch. Sizes from 17 to 108 inches are available. A. G. Heinze Co., Inc.

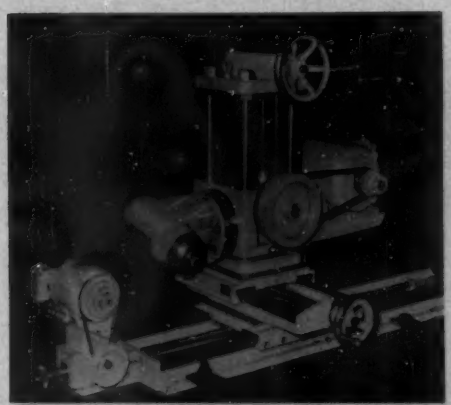
Versatility is the outstanding trend in milling machines and tools.



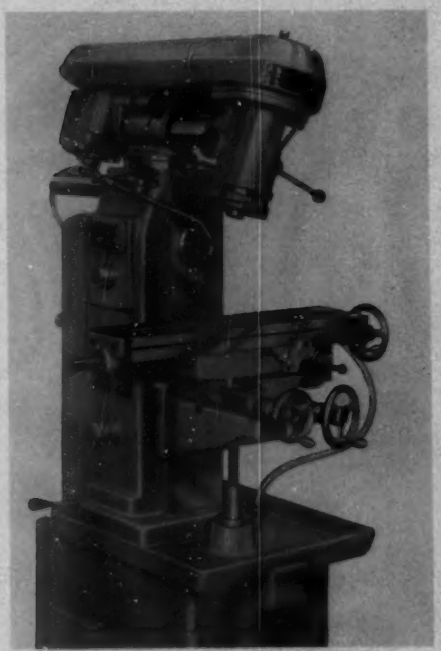
These carbide cutting tools are designed for the routing, milling and trimming of highly abrasive materials such as Fiberglas, Melamine, Plexiglas, laminated plastics and epoxies—all formerly machined only by diamond grinding wheels. The tools can be reground many times. Dixie Tool Industries, Inc.



These Putnam end mills permit milling, profiling, routing or engraving in small or hard-to-get-at areas to be done without special tooling. Available in 110 different types and sizes, the end mills have diameters ranging from 1/32 to 5/16 inch in increments of 1/64 inch. The various types include two flute or four flute. Almquist Tool & Equipment Co.

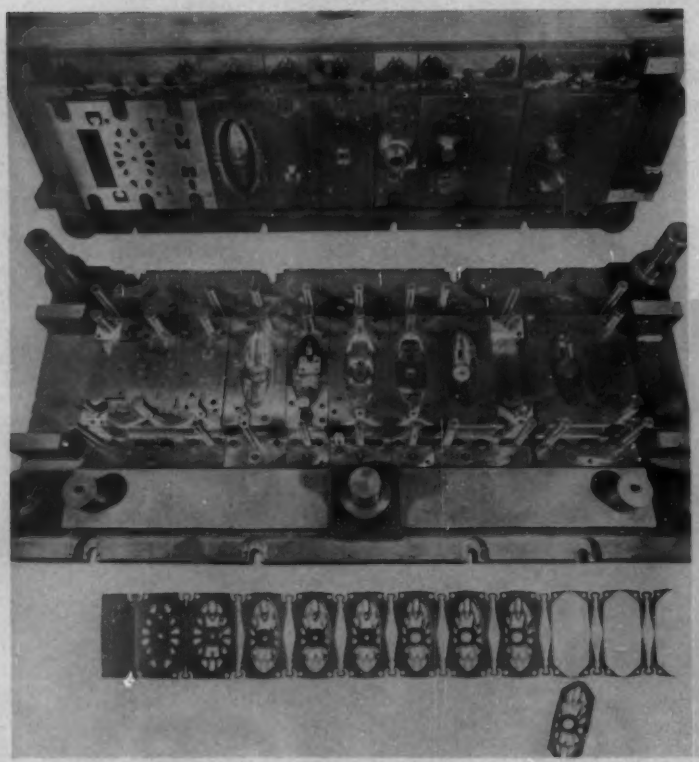


Assembled from standard erector type components, this portable machine tool can be separated into two units. The machining head can be attached to a lathe for milling and the table can be used separately for feeding or positioning work. Built by Master Mfg. Co., Inc., the machine has 45 inches of horizontal travel, 10 inches of cross travel and 12-inch vertical travel. Marshall Tool & Supply Co.

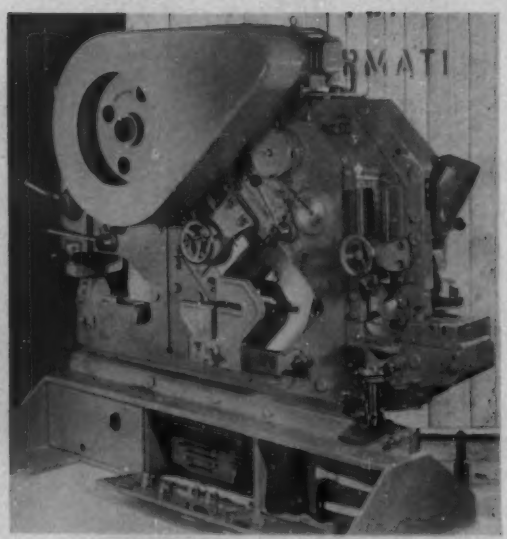


A light small-capacity milling machine, this Junior Omnimil has a vertical spindle head that permits drilling, boring and milling operations at all angles. The head, mounted on a round overarm supported in a turret on the column, can be swiveled in a vertical plane, rotated in a horizontal plane and traversed in the turret. The machine, built by B. Elliott, Ltd., has a 28 x 7-inch worktable.

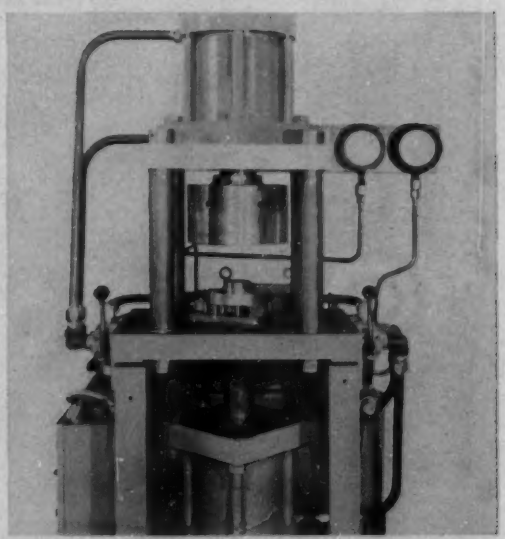
New presses and progressive dies are boosting production rates.



At each stroke of the punch press, this nine-station progressive die produces a complete radio speaker housing. The stations consist of one lancing, two piercing and six forming operations. The forming stations include a drawing operation. Because of the complexity of the hole layout, the panel is pierced before the drawing operation. Perfect alignment is assured by individual guide posts at each station. Laughter Corp.

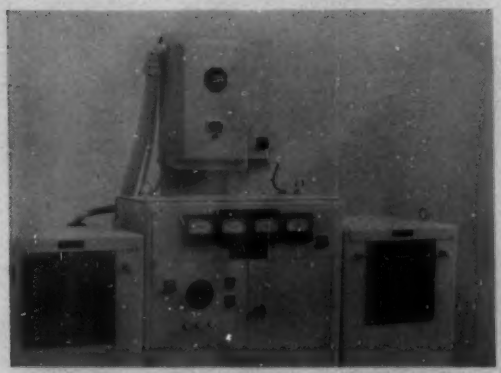


This No. 1/2 Mubea ironworker punches holes, cuts angles and tees, cuts round and square bars, cuts flat steel, copes and notches. It is available in five sizes. E. G. Heller's Son, Inc.

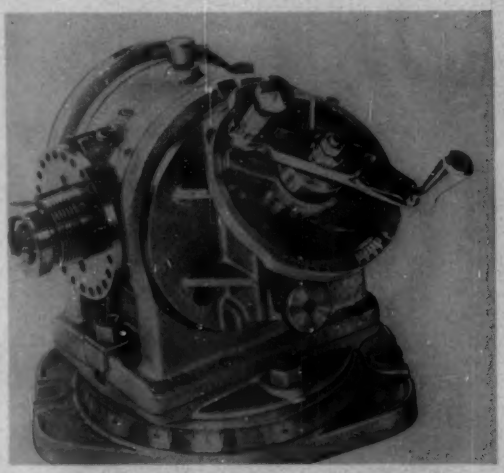


Intended for use in experimental and development shops, this No. 75T hydraulic press develops 75 tons on each cylinder and produces on an average of 150 parts per hour. Palley Supply Co.

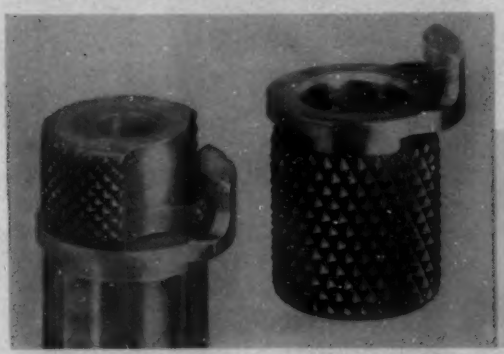
Accuracy of control and convenience in use are outstanding features of new shop equipment.



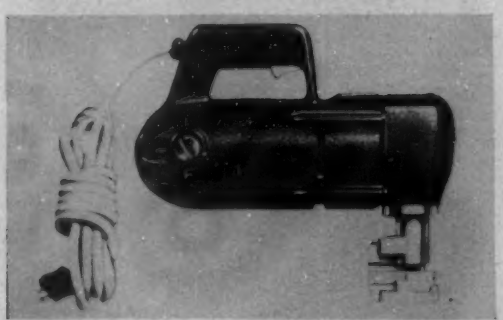
Equipped with a control station and two work stations, this 15-kw Tocco induction heating installation can heat 2¼ x 5/16-inch-thick disks at the rate of one every 7 seconds. The Ohio Crankshaft Co.



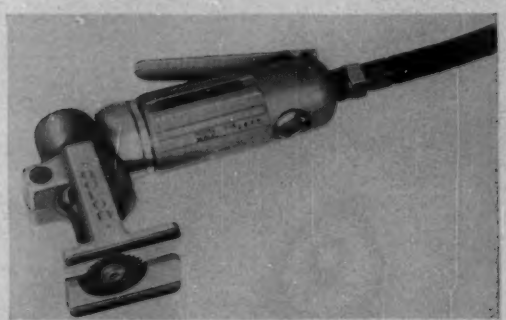
This universal dividing head is used for direct-crank and compound indexing. The swing is 10 inches or, with riser blocks, 12 inches. Built by Ellis Tool & Mfg. Co., the dividing head swivels 10 deg in the vertical plane, below horizontal, and 100 deg in the vertical plane, above horizontal.



These unit locking liners with built-in locking devices eliminate the lockscrew with its necessary layout, locating, drilling and tapping. They are designed by the American Drill Bushing Co. for use with their slip renewable type drill jig bushings. The rotation of the drill inside the bushing keeps the liner securely locked at all times.

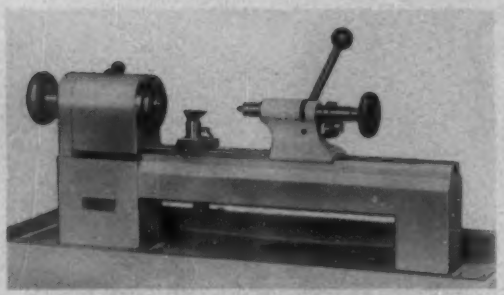


This electric-powered model is representative of Fenway Machine Co.'s line of portable nibblers with cutting capacities ranging up to ¼-inch cold or hot rolled steel and 5/16-inch aluminum. The nibbler cuts all nonferrous metals such as copper, brass and aluminum, also 10-gage stainless steel and corrugated metal. For operator safety, the cut pieces drop down, and fingers are prevented from coming in contact with the cutting action.

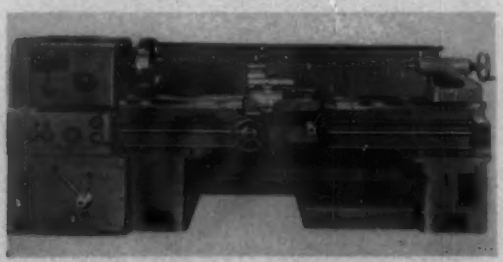


Originally designed for aircraft and missile work, Doeden Tool Corp.'s blind rivet trimmer attachment on their Model 1AE right-angle pneumatic tool can be used in the assembly of truck and house trailers, electronic chassis, boats and appliances. The attachment moves over the work surface in the same manner as a flatiron to avoid loosening the rivet. Its guide surface keeps the circular saw cutter in the correct cutting attitude.

Modern lathes perform contouring, copying, duplicating and threading operations with increased speed and accuracy.



This Model ACDP lathe combines the sensitivity of the jeweler's type lathe with a ⅛-inch collet capacity. The machine has a fully enclosed headstock with V-belt drive and stepless motor control that gives spindle speeds up to 4000 rpm. Dynamic braking and foot control are used for starting and stopping. Louis Levin & Son, Inc.



The Crusader is a medium heavy duty lathe fitted with a 3 1/16-inch hollow spindle, L2 taper nose spindle and 18 spindle speeds. Powered by a 10-hp motor, the machine has a 22-inch swing, metric module and diametric pitches, a totally enclosed feedbox and completely automatic quick change, due to the elimination of the swinging quadrant and change wheels. The leadscrew is 1¾-inch diam, 2-tpi Acme thread and the apron bearing on the bedways is 27 inches. B. Elliott, Ltd.



In addition to threading work, this Man-Au-Cycle threading lathe can be used, with the proper accessory equipment, for external and internal copying, turning, chamfering, facing and shouldering—all in one chucking operation. The 19 models of this lathe have spindle capacities from 1 9/16 to 6 inches and threading lengths from 28 to 80 inches. The lathe is built by S & S Machinery Co.



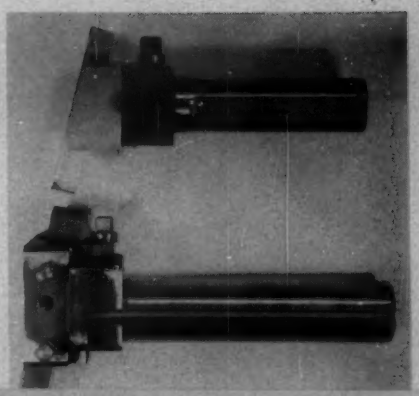
A No. 9000 series hydraulic tracer is shown performing ID contouring on a 6-ft plastic mold which, because of its length, is created in three sections and bolted together. The tracer, used to contour within extreme tolerances, produces a parting line between the die sections. Allied Pacific Mfg. Co.



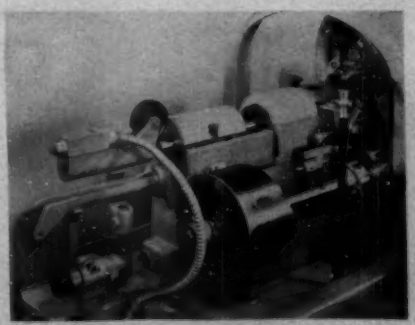
A portable, lightweight lathe tracer attachment made by True-Trace Corp., the Model Mark II is designed to convert an engine lathe to duplicating. The attachment's pivot type design allows it to be used for both shaft and facing duplicating operations. The template and attachment are mounted to the front of the lathe in full view of the operator at all times. Inexpensive flat templates are used.



High-speed automatic copying of almost any combination of diameters, shoulders, bevels and grooves is accomplished with an accuracy of 0.0006 inch on this Ciclomatic production copying lathe. It has 18 or 24-inch swings and automatic changing of preselected speeds and feeds. S & S Machinery Co.



When held in multiple turning heads, these adjustable angle cutter holders are used for finish turning and boring cuts. After a trial cut, final adjustment of the cutter can be made by turning the graduated adjusting screw to the required number of thousandths of an inch. Edward Andrews Tools & Machinery Co.



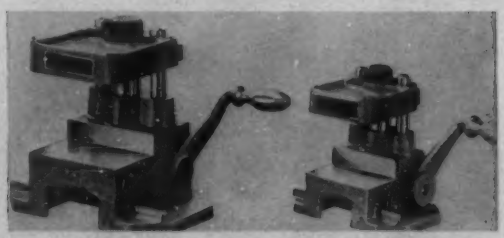
Designed for the automatic production of small precision parts requiring close tolerances of size and concentricity and/or high surface finish, this single-spindle, bar feed, automatic turning machine is especially adapted to the production of long slender parts. It uses the sliding headstock principle in which the revolving bar stock, secured by an automatically operated collet, extends through a supporting guide bushing. About the bushing are arranged five cutting tools, positioned by cams, on which the activity is coordinated with the cam that moves the headstock slide. Thus parts are produced with a single-point tool action. The machine has an independent pulley mounting that makes practical the use of a timing belt drive and an independent bell cam slide that prevents the side thrust of the cam from distorting the slide action. Detroit Cam & Tool Co.

workholders, jigs, fixtures

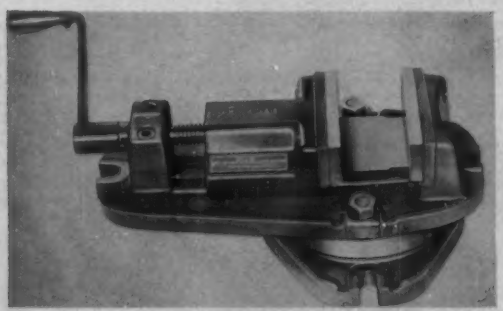
New workholders, jigs and fixtures facilitate setup, shorten cycle time and provide secure locking.



Utilizing the Nylok principle for retention in the tapped hole, these E-Z-Lok threaded inserts are used in the repair of punch press bolster plates and in plastics, wood and other soft materials. The size of the inserts, made by Tool Components, Inc., ranges from 10-24 to 1-8 inside diameter.



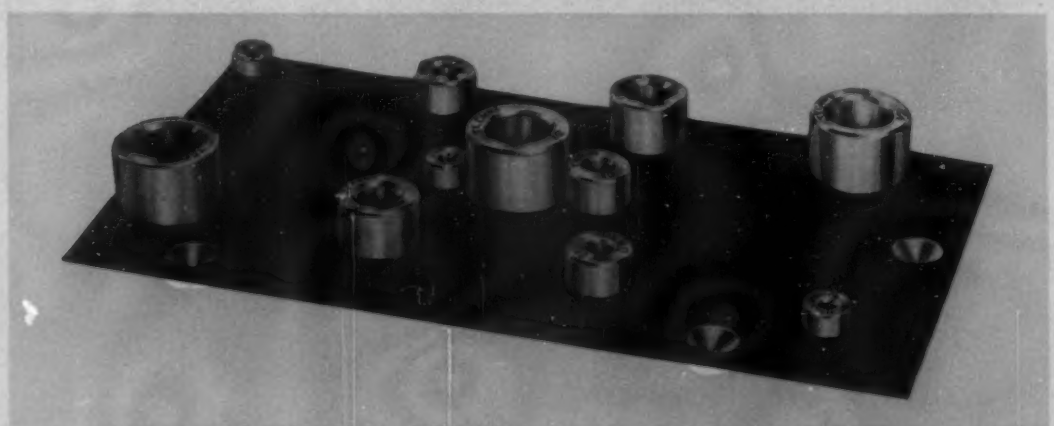
Capable of operation while resting on the base or back face, these Peck-Lewis spring cam-locking pump jigs have a top plate that serves as pressure plate and acts as the surface for mounting the drill bushings. When the jig handle is brought down, the part is clamped tightly in place.



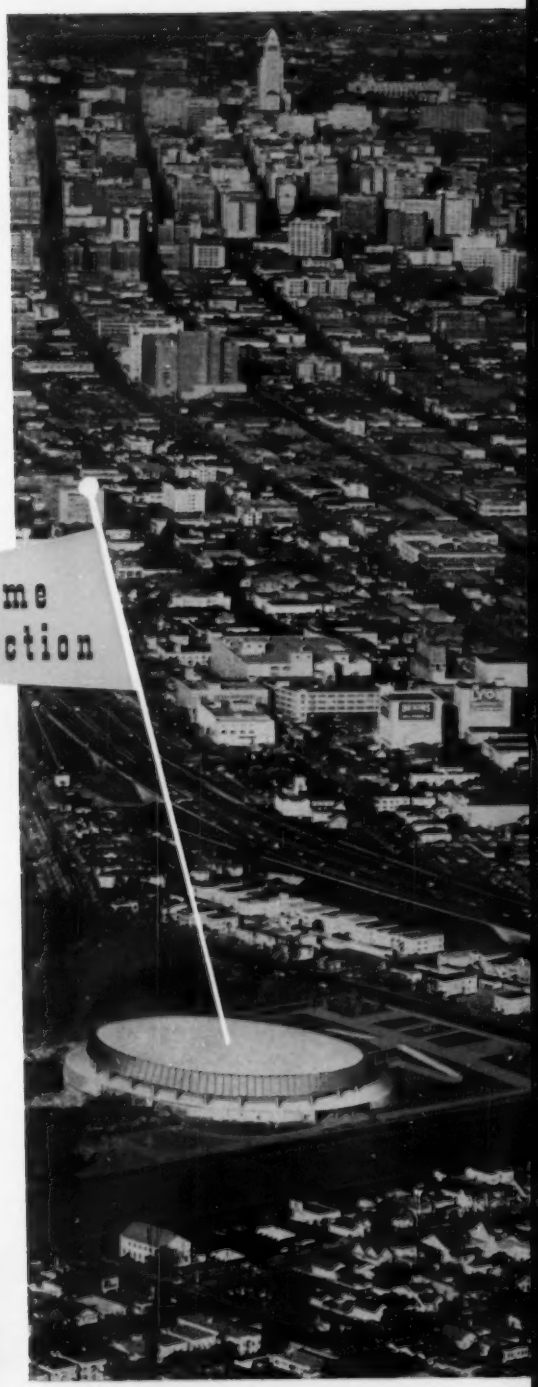
Having a one-piece body casting, this 5-inch, heavy-duty machine vise can be used as a plain or swivel vise. The swivel is 360 deg. Precision-fitted V-slides equipped with an adjustable gib prevent jaws from spreading while in use. Shaped washers eliminate accumulation of dirt and chips in the bolt slots. The vise, made by Ellis Tool & Mfg. Co., is 5⅛ inches high and 16⅝ inches long.



Detroit Stamping Co. manufactures this Model 630 medium-duty plunger type toggle clamp for jobs requiring fast holding action. It has a rated pressure of 1600 lb and locks in either a push or pull direction. Height from the bottom of the base to the top of the handle is 2⅞ inches and the overall length in a forward locked position is 7⅛ inches. The plunger has 2-inch travel on a complete stroke.



Techno-Products Corp.'s Flar-A-Lock drill bushings and work locators can be quickly installed in drill templates, drill plates and drill fixtures from 1/16 to ¼ inch thick. Norman S. Wright & Co.



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Professional Status: Mountain or molehill?

By M. L. Stone
News Editor

AN ENGINEER who isn't quite sure whether he is or isn't an engineer recently commented wryly that the engineering profession — and the whole nation, in fact — was so insufferably wrapped up in status and status symbols that he was sure of only one thing: he was in a thorough status of confusion!

"I expect the next President," he said grimly, "to deliver a Status of the Union, instead of a State of the Union, address."

Meanwhile, like more than half of the 600,000-odd engineers in this country, he goes about his business not quite sure whether his status is "professional" or "nonprofessional," "registered" or self-styled, doctor or nurse, fish or fowl . . . .

This engineer disclaimed any personal neurosis about status-seeking complexes. In fact, he averred, most engineers he had ever met on the job or at Society meetings were not so concerned with their professional status as they were with their financial status. But more and more, he admitted, his professional status was threatening to determine whether he earned bread and butter, or bread and a low-priced spread.

And well he might be concerned. Certain recent developments in the field of engineering professionalism are likely to affect him and his 350,000 fellows who are called engineers by everybody except their 250,000 fellow engineers who are registered professionals. These developments have occupied the attention of ASTME's four-member National Professional Development Committee for several months past, and will occupy the attention of the National Board of Directors at their Semiannual Meeting in Los Angeles this month.

The ASTME directors are certain to discuss, and are likely to take a stand on, the following professional developments:

1. The National Society of Professional Engineers (NSPE) has embarked upon a crash program to certify technicians and technologists. Under NSPE sponsorship, an "institute" will be formed to administer certification examinations, beginning Jan. 1, 1961. The institute will eventually form the nucleus of an organization to be called the National Society of Engineering Technicians.

2. Several rulings of the National Labor Relations Board (NLRB) have held that certain classifications of engineers usually associated with ASTME membership are nonprofessional technical employees.

Implications of Technician Program

NSPE's objective in sponsoring the certified engineering technician program is in large part to set up a buffer zone between registered professional engineers and the efforts of unions to organize them. The professional engineers hope, through such a certification program, to provide incentive for attainment of enough status to discourage the encroachments of unionism among technical personnel.

The idea of technician certification is not original with NSPE. The Association of Professional Engineers of Ontario placed an engineering technician program in operation in 1957. Possibly because there has since been no mad rush of applicants for such certification in the province, the professional engineers attempted to ram legislation through the Ontario Legislature providing for legal registration of engineering technicians. The legislation—Bill 36—failed to pass during the 1960 session. Legal counsel for ASTME's Canadian members prepared and presented a brief protesting Bill 36 as special-interest legislation which would virtually create a "closed shop" with respect to the engineering profession in Ontario. The brief declared, "It is the belief of the Society that an industrial concern hires and will continue to hire a man on his ability and not on his degrees." ASTME's attorney has predicted the bill will not be reintroduced in 1961.

In the United States, NSPE's plans for a similar certification program do not envisage any attempt to foster legislation.

Now what does all this imply, collectively and individually, for ASTME?

There are three official courses of action open to the Society. The alternatives are to endorse the technician program, to oppose it, or to ignore it.

Those favoring endorsement of the program point

out its advantages to tool and manufacturing people who, because of economic, social or personal reasons, may decide the status of technician is the most feasible goal in life for them. They see it as a realistic way, too, to upgrade the Society membership on a professional basis.

There is precedent for official ASTME action on a technician registration program. The Society's Board of Directors at the Semiannual Meeting of October 1959 urged the Professional Development Committee to inform Canadian members about the Ontario technician program, but declined outright endorsement.

Opponents of the technician program feel that it is highly important for the Society to keep its sights up. They are afraid that such a program will eventually downgrade ASTME into the role of an organization composed of technicians, not engineers. They point out that ASTME is chartered as an engineering society and should continually conduct itself as such. They feel that such a development would exploit the very philosophy that made ASTME great and strong—the Society's acceptance of earnest members, regardless of formal education, who desire to grow in engineering knowledge and improve industry's production methods. In short, they fear technician certification would spell the end of the self-made engineer.

Those who would ignore the technician program and other status symbols might argue: "Let us not confuse the issue. ASTME's real reason for being is to help its members. Its purpose is not to tyrannize its individual members in order to raise its collective 'status' to that of the so-called founders' societies. Its purpose is not to encourage unions or to combat them. Its purpose is not to kowtow to any bigoted groups bent on promoting self-interests. Its purpose is to help its members make a better living for themselves and a better standard of living for everybody."

Explanation of NLRB Rulings

The National Labor Relations Board follows the precept that it is the work performed, and not the individual qualifications of the worker, that controls determination of a man's professional status. With this most Society members are apparently in agreement. Nor will many members argue with NLRB's premise that "knowledge of an advanced type" should serve as one of the yardsticks in determining whether a given job is professional or nonprofessional. Some Society members, however, are openly concerned with the apparent tendency of the NLRB in recent cases to apply that yardstick too rigorously—i.e., declaring a group nonprofessional when a majority of that group are not degree holders.

The definition of a professional employee as set forth in the Labor Management Relations Act (commonly called Taft-Hartley) of 1947 is as follows:

> Any employee engaged in work (i) predominantly intellectual and varied in character as opposed to routine mental, manual, mechanical or physical work; (ii) involving the consistent exercise of discretion and judgment in its performance; (iii) of such a character that the output produced or the result accomplished cannot be standardized in relation to a given period of time; (iv) requiring knowledge of an advanced type in a field of science or learning customarily acquired by a prolonged course of specialized intellectual instruction and study in an institution of higher learning. . . .

Critics of the NLRB decisions point out that the fourth requisite, "knowledge of an advanced type," is *customarily* but not necessarily acquired in an academic situation.

No one in the Society, of course, can effectively challenge the decisions of the NLRB. Society members can, however, do these things: make their views known; determine what the consequences might be if they are ruled nonprofessional and therefore vulnerable to unionization; and *embark upon definite educational pursuits to raise their status* out of the twilight zone.

Results of ASTME Survey

Chairman Charles H. Thuman of the National Professional Development Committee, recently sent out a questionnaire to chapter PD and education chairmen. He asked for, and got, "frank answers" to the following questions:

- What percentage of the members of your chapter could qualify as engineering technicians (technical institute graduates or equivalent, plus examination)? The averaged answer from respondents was 52.4 percent.
- Do you favor the registration of technicians and technologists? The answer was 63 percent yes, 33 percent no, 4 percent uncommitted.
- Do you feel that tool and manufacturing engineers should be considered as technical employees or as professional engineers? The answer was 57 percent as professional engineers.
- Looking at ASTME's long-range goals, would the first and third questions above hinder the Society's future? The answer was 57 percent no.
- Should ASTME support the future National Society of Engineering Technicians? The answer was 62 percent yes.

The official position of ASTME will be known after the Semiannual Meeting a few days hence in Los Angeles. Whatever it may be, the developments discussed above should alert the individual member to thinking about his professional status. Is status a mountain or a molehill to him? If it is a mountain, then perhaps he should set about climbing it. If it is a molehill, then he should set about finding a mountain that matters to climb.



Prof. Howard O. Rust
Faculty Adviser at KU



Prof. Paul G. Hausman
Faculty Adviser at KU

Training Ground for Society Leaders

THE FERTILE LAND of Kansas is famous for jayhawks, sunflowers, airplanes, wheat and, some people will add, Republicans.

However, of more relevance to engineers is the fertility of ASTME in such places as Coffeyville and Wichita and Lawrence. . . .

At Lawrence, some of the state's most fertile—and most altitudinal—acres comprise an educational complex affectionately known as "Mount Gilead" but sometimes referred to as the University of Kansas. The university is perched on landscaped bluffs at the confluence of the Kaw and the Wakarusa rivers, and the aspiring students veritably climb the trees of knowledge. When they graduate, they have a good inkling of what the founding fathers meant when they gave the state its motto: "Ad Astra per Aspera: To the Stars Through Difficulties."

Hanging over one bluff is an aging stone building with a newish metal sign saying "FOWLER SHOPS: Engineering Manufacturing Processes." This is the home of one of the oldest and indisputably one of the most active student chapters.

Although Student Chapter 3 of the University of Kansas was organized and affiliated with the senior chapter in Kansas City in the fall of 1946, its official charter is newish. The director of KU's industrial engineering school and on alternate years the faculty adviser of the ASTME group, Prof. Paul G. Hausman, likes to tell this story:

"I wrote to the Society as far back as May 1946, trying to get a charter for 38 of my students who wanted to become a Society chapter. Headquarters told me there was no such thing as student chapters then. So we affiliated with Kansas City, whose chairman that year was Amber M. Brunson (of Brunson Instruments).

"Years passed. Then I happened to be in Ann Arbor, and happened to see a fresh certificate on the wall there which was the charter for the University of Michigan Student Chapter 1. It was the first I knew that National had started chartering student groups.

"So we got busy and got a charter—eight years after our 'birth.'"

The KU chapter was officially launched on Oct. 15, 1954, on the same day that the Society's Student Chapter 2 was born at Utah State University under the guidance of another ASTME education pioneer, Prof. Frederick Preator.

The chartering ceremonies at Lawrence were a family affair. The 1954 student chapter chairman, Donovan Hill, accepted the charter from Harold Buddenbohm, who was then chairman of



Here's the home of University of Kansas Student Chapter 3, as a student would see it during his 40-step climb from a campus road below. Behind the stone walls is a well-equipped industrial engineering department presided over by Prof. Paul G. Hausman. Jerry L. Stracke is this year's chairman of the 109-member student chapter.

the Kansas City chapter—and who was a past chairman of the university group.

Buddenbohm's double connection with the senior and the student chapters was nothing unusual. KU Chapter 2 has particularly distinguished itself over the years as a training ground for senior chapter leaders.

Besides Buddenbohm, who has since gone on to become superintendent of the Chicago Art Institute, the following former chairmen of the student group have served as chairmen of senior chapters: John Hoover, Ralph Adkins and Joseph Gardner, all past chairmen of Kansas City chapter; and John Hopkins, past chairman of Louisville Chapter 54. Another past student chairman, Gene E. Brunson, has been active on Kansas City committees for years and is chairman of the education committee.

The list runs on. Harold Shigley, a former member of KU chapter, sparkplugged organization of the student chapter at Wichita University. Tom Fisher, former secretary and first vice chairman at KU, came up to GM in Michigan and became chairman of the Oakland County (Pontiac) chapter, according to Professor Hausman. Paul Johnson, former KU chairman, has recently returned to the university as an instructor and is still in ASTME.

Hausman and his colleague, Prof. Howard O. Rust, alternate as advisers to the student group. They report that the membership has never fallen below 50 since 1947. It now stands at 109.

Much of the credit for nurturing the KU student engineers through the early years, says Hausman, must go to five past chairmen of Kansas City: Amber Brunson, Leroy Campbell, Jack Merrick, H. Robert Brown and Ward Osborn.

Although formal links with the senior chapter at Kansas City were severed with the chartering in 1954, a close informal relationship remains. It is a rare meeting at KU that does not find ten or twelve senior members from KC present. And there's a possibility that this relationship may be formalized this year with a campus conference jointly hosted by KU and KC chapters.

The ASTME group at KU is far and away the most active professional aggregation on the campus.

Hausman and Rust reported that the question most frequently asked of them by fellow faculty members from other schools and departments is, "How do you get all those people to attend your ASTME meetings?"

The answer, they say, is a bilateral one: ASTME is first of all an organization that has something to offer the students, competing successfully for their time and talent with the scores of other curricular and extracurricular interests; and, second, the students get the opportunity to contribute to the

First Student Chapter Dates Back to 1938

Although the first student charters were granted to groups at the University of Michigan, University of Kansas and Utah State, those chapters were not the first to be formed in the Society.

A search of back issues of this magazine revealed a news story in May, 1938, telling of the formation of "the first student chapter of ASTE" at the Detroit College of Applied Science. The article further reported that the first chairman of the fledgling group was Thomas Sheehan and the first chapter secretary was James Lamb, son of then National President Ford R. Lamb. The 50-member chapter also claimed the first female member of the Society—student Margaret Irene Cecil.

Other "oldies" among student ASTME organizations are at Tri-State College in Fort Wayne (chartered as a separate student chapter only last year), Purdue and Ohio State.

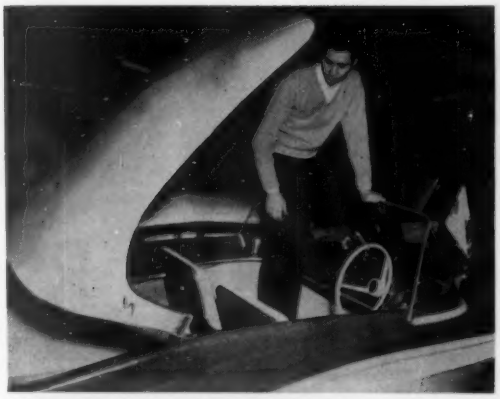
Since chartering of the first student chapters in 1954 a total of 32 such groups have come into the Society. The latest was chartered at Penn State's Ogontz campus.

profession they have chosen. They, in short, run the chapter.

Their affiliation with ASTME almost invariably pays off when job interviewers come around, Hausman added. The fact that students are voluntarily active in an organization that is dedicated to the gentle art of learning stands out on application blanks. It indicates to the interviewer that such students are aggressively intent on bettering themselves, and are not afraid of extra effort. To those students go the extra rewards.

Part of the attraction for KU enrollment and for ASTME membership is the well-equipped Manufacturing Processes labs. A feature of the labs, furnishing the basis of the department's freshman orientation course, is a miniature production line taking a chosen item through all the steps from planning and setup to the finished product.

The wise freshman on Mount Gilead who buttresses his classwork with ASTME membership learns how to make a finished product out of himself too.



Although KU is a training ground for Society leaders through the campus chapter, Faculty Adviser Hausman is quick to point out that the university also turns out engineers. He is ready to cite many of his students who have made good—one of those being ASTME member Ronald E. Hill (above), a 1957 graduate who now owns and operates an engineering firm outside Kansas City. Hill is shown demonstrating one of his newest designs, a hardtop for pleasure craft.

Metalcutting Bibliography Off the Press

A THOUSAND-PAGE *Metalcutting Bibliography,* containing almost 6000 abstracts of literature on chip-producing processes, has been published by ASTME's Research Fund. The monumental reference work was produced in the hope of measurably reducing the $10 billion a year cost of making chips in this country.

The "New Testament" for industry's metalcutting legions—which takes up the story where the old O. W. Boston Bibliography left off in 1942—is the result of four years of work contracted by the Research Fund to The John Crerar Library in Chicago. A staff of experts at Crerar reviewed more than 18,000 books, papers, pamphlets and articles, and from this mass of material prepared 5593 abstracts of original contributions to the art and science of metalcutting. The abstracts include "see also" references for duplicate works. Also in the bibliography are a 162-page subject index and a 19-page author index.

The bibliography, available at $20 a copy, is the Research Fund's first venture into hard-cover volumes. It represents just one phase of the fund's long-range metalcutting project; an "Evaluation of Metalcutting Literature" and a machinability testing project have already been completed.

The task was supervised by the Research Fund's special Metalcutting Project Committee, headed by David N. Smith, chief development engineer, Jones & Lamson Machine Co., Springfield, Vt. Other members of the committee include E. M. Barber, resident supervisor, Texaco, Inc.; F. J. Daasch, chief machinability engineer, Rock Island Arsenal Laboratory; Hans Ernst, University of Cincinnati professor; E. L. Fowler, Research Div., International Nickel Co.; W. W. Gilbert, manager of machining development service, General Electric; Charles H. Good, plant manager, Micrometrical Development Corp.; E. J. Kaiser, vice president-manufacturing, Giddings & Lewis Machine Tool Co.; W. B. Kennedy, chief of the experimental machining branch, Rodman Laboratory, Watertown Arsenal; W. F. Klein, manufacturing research, Ford Motor Co.; W. T. Lankford, chief research engineer, U. S. Steel Corp.; Daniel J. Martin, vice president-engineering, Hughes Tool Co.; M. Eugene Merchant, director of physical research, The Cincinnati Milling Machine Co.; John W. Molinar, general sales manager, Union Twist Drill Co.; Carl J. Oxford, Sr., vice president-engineering, National Twist Drill & Tool Co.; George A. Roberts, vice president-technology, Vanadium-Alloys Steel Co.; A. O. Schaefer, president, Pencoyd Steel & Forge Corp.; F. Forrest Stretmater, chief metallurgical engineer, Reynolds Metals Co.; Earle C. Smith, director of research, Republic Steel Corp.; J. T. Welch, vice president-sales, Sheffield Corp.

A critical review of the Metalcutting Bibliography will be found in the "Engineering Bookshelf" department of this issue, Page 214.

Anatomy of Research

A NONPROFIT ORGANIZATION such as ASTME is particularly well-suited to assume a commanding role in research, Windsor chapter was told by Society Research Director Leslie S. Fletcher.

Because of the prohibitive expense of facilities and top talent, Fletcher said, research is increasingly becoming a cooperative venture. It is increasingly necessary that organizations with no ax to grind furnish inspiration and leadership.

Societies such as ASTME should become the catalysts in cooperative research programs, Fletcher indicated.

He defined basic or applied basic research as the "probe for new knowledge without any immediate need for that knowledge," as opposed to developmental research which is the search for new knowledge needed to solve a known problem.

In his analysis of the multibillion-dollar research business in America, Fletcher told Chapter 55:

"It is in cooperative research, where we want everyone to win and no one to receive special consideration or unfair advantage, that the leadership of a professional society can be the deciding factor in the success—or failure—of research projects. This is adequate justification for ASTME to actively take part in research. It is more than that —it is a mandate."

Fletcher's address, entitled "Research for Progress Unlimited," explored the roles of various organizations that perform or sponsor research. He said this tremendous nationwide search for new knowledge is being carried on by universities, research institutes, government, industry, private laboratories, societies and trade organizations, and—almost a thing of the past—a few individuals. Aside from a handful of exceptions among the very largest companies, such as GE, Westinghouse, GM, Ford, du Pont, U. S. Steel and Standard Oil, industry does relatively little basic research. The number of societies and trade groups in basic research is surprisingly large, Fletcher said, and ASTME is one of the leaders.

He listed additional reasons why research merits Society backing: it maintains and elevates the professional prestige of the Society; it furthers the self-help or self-education aim of ASTME by providing advanced knowledge for continued professional development of already professional men; and it benefits industry by providing new and nonproprietary knowledge that industry would be reluctant to spend its stockholders' dollars on.

The Society's Research Fund Committee, which has developed a notable project history in such fields as metalcutting, metal stamping, metallic borides, plastics for tooling and cutting fluids, abides by certain ethical restrictions in all its programs, Fletcher pointed out. A project must involve research basic in nature while having practical objectives; it must not be in competition with industry or with other organizations; and, finally, the results of the research must be made fully and promptly available to all interested parties.

Moral Obligation on Industry's Part

Fletcher contended that there's a sort of moral obligation on the part of industry to support cooperative basic research. "Since all will benefit, all should share the cost," he asserted.

To date, 29 research reports resulting from Society-sponsored projects are helping to fill critical gaps in this country's technology. These reports are available from ASTME Headquarters.

The National Science Foundation, in a recent report on R & D expenditures in nonprofit institutions, praised the initiative of professional and technical societies in certain neglected fields of research. Further, the Foundation said, scientific investigators in all fields are linked by their membership in societies which facilitate the interchange of information through publications, annual meetings and conferences.

Of 131 professional and technical societies surveyed by the National Science Foundation, 49 reported activity in research. Of the 49 societies, 16 supported research within their own institutions; 27 backed research by means of grants or contracts; and 6 supported work both within and outside their organizations. The annual research expenditures of this nonprofit group totaled $6.7 million, of which 55 percent was basic research.



George T. Morris

Members in the News

Ray H. Morris & Co. has announced the appointment of GEORGE T. MORRIS, Philadelphia chapter, as vice president. Morris, who has had 17 years' experience as a sales and field engineer, will assist the president—his father—in the general administration of the organization and the furthering of sales and service activities. The senior Morris is a past national president of ASTME and a member of Hartford chapter.

E. W. KALB, Pittsburgh, has been named manager of market development for Vanadium-Alloys Steel Co. Kalb brings to his position a 23-year background of steel marketing experience. His new duties will be concerned with the promotion of new steel grades and development of new markets.

FRANCIS E. GRUBER, past chairman of Twin Cities chapter and a former vice president of Brown & Bigelow, has been appointed chief engineer for Northwest Plastics Inc. of St. Paul. Gruber joined Brown & Bigelow in 1933 and was made vice president in 1946 after a number of years of supervising engineering and installation projects.

R. A. LEHNER, vice president and general manager of Joy Mfg. Co.'s Coal Machinery Div., has also assumed responsibilities of works manager at the company's plants in Franklin, Pa. . . . Formerly an abrasive engineer with Norton Co. in Chicago, PAUL H. CARLSON, Milwaukee, has been reassigned to the Los Angeles area. . . . Apex Broach Co. has appointed DON PASTULA, Hartford, and GORDON POWER, Tri Cities, as sales representatives in their home areas. . . . W. F. & John Barnes Co., machine tool builder of Rockford, Ill., has disposed of its interests to WILLIAM W. BARTON and BRUCE G. MILLER, a member of Rockford chapter, who assumes the office of president. RAPHAEL AMBROSE, EDWIN WALKER and S. ARTHUR GETTS, all members of Rockford chapter, will remain with the company as sales manager, chief engineer and superintendent.

positions wanted

CAPABLE ESTABLISHED SALES ENGINEERING firm with design and manufacturing background, now selling electronic, pneumatic and mechanical gages, conventional gages, production and cutting tools in New York-New Jersey area, desires additional product lines. Prefer exclusive arrangement with established manufacturers. Stocking facilities. Write to Classified Ads, Dept. 189, 10700 Puritan Ave., Detroit 38, Mich.

METAL STAMPING SALES—Well-known executive offering millions of dollars of sales, metal stamping, tools, dies and assembled products is open for proposition. Principals only. Write to Classified Ads, Dept. 190, 10700 Puritan Ave., Detroit 38, Mich.

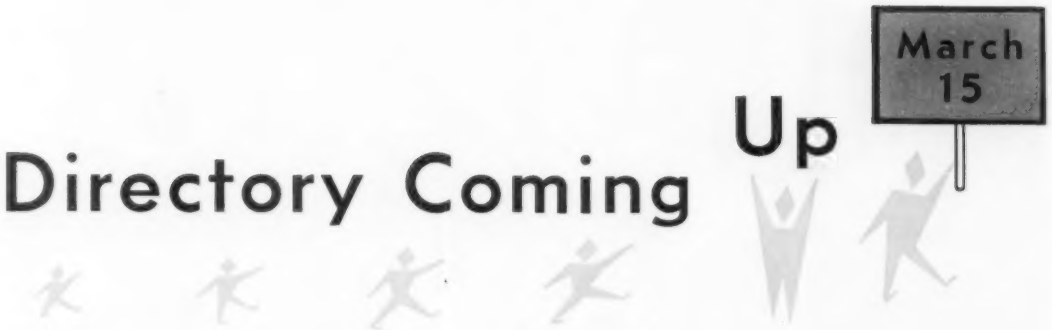
positions available

FIELD SERVICE ENGINEER—with extensive cutting tool experience and acceptance in metal fabricating industry, by a well-established Pennsylvania manufacturer of taps, dies, reamers, end mills and milling cutters. Excellent compensation and future. Reply in confidence to Classified Ads, Dept. 191, 10700 Puritan Ave., Detroit 38, Mich.

INSTRUCTORS IN TOOL DESIGN AND MACHINE DESIGN—with ME or IE background. Two-year MSA-accredited college of State University of New York. Excellent opportunities for professional development; new, growing campus. B.S. required. Master's degree and/or teaching experience desirable. Starting salaries to $7500 depending on experience, background, etc. Write full details to Mr. Benjamin Davis, Head, Mechanical Dept., Mohawk Valley Technical Institute, Utica, N. Y.

SUPERINTENDENT (Die Cast Operation)—Experienced man to assume responsibility for the establishment and operation of a complete die-casting facility in our new projector plant. Extensive experience in all phases of die casting essential. Background in processing, tool and die design and other engineering sciences will further qualify applicant. Reply by letter to employment manager, stating age, education, experience and salary requirements. Argus Cameras, 405-4th St., Ann Arbor, Mich. Arthur Parker, Jr., Employment Manager.

Directory Coming Up



MARCH WINDS this year will be blowing a mighty important package to ASTME members. The 1961 Directory of Suppliers—formerly the Suppliers Directory published in the June 15 issue of THE TOOL AND MANUFACTURING ENGINEER—will make its debut on March 15, the new publication date of the magazine's 13th or bonus issue.

The revised name—Directory of Suppliers—clarifies the scope of the publication. It is a listing of suppliers that is used by men in all phases of the metalworking industry, not a directory put out specifically for suppliers.

The new, and fast-approaching, publication date of the Directory has made some audible changes here at Headquarters. Quiet and tranquil since June 15, the directory office suddenly began rumbling last September. Directory Editor Daniel Dallas and his assistant Nancy Warren were preparing forms to be mailed to thousands of companies. These forms, sent out in October, enable a manufacturer to list for directory publication the products he manufactures for sale and the local sales offices that handle these products.

Now, as material rolls in from all over the nation, directory office activity is at the booming stage. But despite the complexity of the project, things are running smoothly because of staff experience gained in compiling two previous directories and the help of IBM in processing forms.

No Change in Service

Although the name and publication date will be changed next year, the basic facts about the directory will remain unaltered: it is a complete information service on products, listing manufacturers and their sales offices; it is a valuable service to ASTME members and to industry.

The 1961 directory will be immediately recognized by the familiar color-coded sections—blue for Products, yellow for Manufacturers and pink for Sales Offices. The listing of products will cover, as completely as possible, everything needed for efficient production. Both the products and manufacturers sections will be thoroughly cross-indexed. According to the directory editor, the manufacturers section will be expanded.

The convenient step-by-step procedure for using the directory, already familiar to thousands, will be the same as in the June 15 issue. The content will be all new and original material direct from the manufacturer.

The value of this publication is evident not only in the service it provides, but in the reactions of those who use it and list their products in it. Here's a sampling of the present directory's extensive compliment file: ". . . this Suppliers Directory is a wonderful idea . . . thanks for getting us started in your excellent cross-reference setup, both on product listings and main and division office locations . . . thank you again for this service of having our products and sales offices listed as ready reference so that many thousands of capable tool engineers throughout the world can make use of this service . . . thanks for your extra attention to a small company such as ourselves because most listings usually shuffle over us in favor of big names."

And from a real cool engineer came, "We think the Directory is a gasser." This, in more familiar English, means the gentleman was pleased with his directory.

Anxious to further increase the value of the directory, the staff is using every effort to make the list of manufacturers more complete. Unfortunately, the enormity of the directory operation causes some companies to be overlooked. Regrettably, these oversights can pertain to companies in which some employees are ASTME members. In such a case, the editors would greatly appreciate the members' help in correcting the situation.

If a member notices that his company is not listed in the 1960 directory, he should send the following information to the Directory Editor at Society Headquarters: the name and address of the company, the name and title of the person to contact for official information, and the names of the products manufactured for sale of the type specified by tool and manufacturing engineers.

ASTME

America's Success Through Manufacturing Efficiency

Los Angeles:

Host with the Most

WHEN UPWARDS of 10,000 people descend on Los Angeles this month for ASTME's Western Engineering Conference and Exhibit, there'll be method in their madness.

Perhaps some of them will go to L. A. because they want to see the porpoises cavort at Marineland, or other things cavort at other places. Some may go to see Hollywood, or Disneyland, or Knott's Berry Farm, or the freeways. A few may even go because they want to savor the bracing air of a metropolis where low-flying angels wear gas masks. . . .

But all of them will have one madness in common —an interest in manufacturing methods. To this end, come Nov. 14 to 18, they will have an opportunity to attend eleven technical sessions, ten plant tours, several special-interest events, untold bull sessions, the Semiannual Meeting of the national directors of the sponsoring Society, and a $5-million tool show at the gleaming, dollar-shaped Memorial Sports Arena. In addition, for those with the inclination and certain physical prerequisites, there's a wholesome round of ladies activities ranging from tea (in the Ambassador Hotel, Monday afternoon) to symmetry (fashion show at Bullock's Wilshire, Tuesday).

A complete schedule of Los Angeles events, by day and hour, starts overleaf.

The Tool Show

Three or four miles out the Harbor Freeway from downtown is the Sports Arena.

Ranged row on row there will be 2000 products, many of them new and all of them expressive of the world of tomorrow that the tool and manufacturing industry is shaping today. Although the 1960 ASTME Western Tool Show is regionally labeled, the 200 exhibitors will come from every part of the country and every branch of the industry.

The selection of this year's theme, "America's Success Through Manufacturing Efficiency," came easy for the Los Angeles Host Committee. It not only fit the initials of the sponsoring Society, but it was most fitting for a western show, said Host Committee Chairman Rudolph Regen. Nowhere is success more evident than in the booming West, and nowhere is efficiency better exemplified than in the highly geared industries of the Los Angeles metropolitan area.

Statistics in the West, like the scenery, are apt to be spectacular. Indicative of the region's growing importance in the tool and manufacturing industry, for example, is the rise in the number of metalworking employees from 710,492 in 1954 to 879,822 in the last census. Another yardstick of progress—the "value added" by manufacturing, meaning the value of products less some manufacturing costs—shows a $2.9-billion climb during the same period to a grand total of $8.5 billion. At last count there were 30,037 metalworking plants in the 13-state western area including Alaska and Hawaii.

Los Angeles has taken the national lead in the number of machine shops employing more than 20 men. It is second only to Chicago in large screw machine products plants. During 1959, manufacturing employment in the Los Angeles area averaged 769,800, double the average of a decade before. Metropolitan Los Angeles accounted for 19 percent of the net gain in manufacturing employment in the whole nation during the last decade, making it the fastest growing industrial area.

"Western industry has made an unequaled contribution to our success in the missile, aircraft and electronics fields," declared Harry E. Conrad, executive secretary of ASTME. "The new methods, techniques and equipment devised by space-minded Western engineers have been adapted to other industries to provide consumers with new and revolutionary products to raise our high standard of living even higher."

The Society's Western Tool Shows, held previ-



Walter Kassebohm
Public Affairs Forum Moderator

ously in 1955 and 1958, have paralleled this expansion. The 1960 version is moving into the new Sports Arena because it has outgrown the confines of the previous Tool Show site, the Shrine Auditorium.

Opening the five-day show will be the California Day Luncheon, a tribute to local industry, on Monday, Nov. 14. The keynote speaker will be Maj. Gen. Osmond J. Ritland, commander of the Air Force Ballistic Missile Division at Los Angeles.

The Technical Program

Complementing the productivity ideas on display at the Sports Arena will be 23 technical papers presented during a variety of sessions at the conference headquarters hotel, the Ambassador.

Starting Monday with a three-paper session on "Ceramic Cutting Tools Updated," the technical program will cover such topics as carbide tools, chemical milling, servomechanism controls, numerical control retrofit of machine tools, precision barrel finishing, electroforming and plasmarc coating. Two "Techtours," integrating papers with applicable plant demonstrations, will be held on powder metallurgy and small-shop numerical control. Preregistration is necessary for the Techtours.

Ten tours of interesting plants and installations in the area have been arranged by the Host Committee. Round-trip transportation is $1.75 per tour, and tickets may be bought at the point of departure.

Details of all the tours and technical sessions will be found in the following pages of the "Daily Schedule of Events."

Public Affairs Program

Of special interest to civic-minded convention visitors will be a "Public Affairs Forum on the Race for Manufacturing Supremacy," to be held Tuesday, Nov. 15, in the chemistry-geology building at UCLA (University of California at Los Angeles). Four men who have witnessed Communist industry in action will attempt to evaluate manufacturing progress behind the iron curtain.

Cosponsored by ASTME and UCLA, the forum will be moderated by Walter Kassebohm, executive vice president and general manager of Marchant Calculators, Oakland, Calif., and a member of ASTME's National Exposition Committee.

After the forum, participants will tour the university's $5-million data processing center, nuclear training reactor and cyclotron site.

Meeting of the Membership

Of prime importance to the nearly 4000 members of the dozen ASTME chapters in California, as well as to the 36,000 other members in the rest of the Society's chapters, is the Semiannual Meeting. All members are welcome to attend the 9 am to 5 pm sessions of the National Board of Directors, scheduled for Wednesday and Thursday, Nov. 16 and 17, in the Embassy Room of the Ambassador Hotel.

The Semiannual Meeting dinner dance at the Ambassador will climax the week-long activities on Thursday evening, Nov. 16.

A post-convention family tour of Palm Springs, California's desert playground, has been arranged for Saturday, Nov. 19.



Four Los Angeles conference planners posed outside a San Francisco meeting place during a recent California Council workshop. Seated are William Forbes, Santa Clara Valley chapter, and Rudolph Regen, Los Angeles Host Committee chairman; standing are L. Dean Roulund, Golden Gate chapter, and Art Dzigorski, Sacramento.

1960 ASTME Western Engineering Conference and Exhibit

When:

Monday, Nov. 14 through Friday, Nov. 18.

Where:

Tool Show: Los Angeles Sports Arena
Technical Sessions: Ambassador Hotel, 3400 Wilshire Blvd.
Annual Meeting and Special Events: Ambassador Hotel

Tool Show Hours:

Monday through Wednesday, 1 pm—10 pm
Thursday and Friday, 9 am—5 pm

Registration:

In addition to registration which will be conducted at the Sports Arena during all hours of the exhibit, a registration area and headquarters will be maintained in the main lobby of the Ambassador Hotel.

Sunday	4:00 pm— 8 pm
Monday	8:00 am— 4 pm
Tuesday through Thursday	7:30 am— 4 pm
Friday	7:30 am—10 am

General Information:

- Frequent shuttle service will be provided between the Ambassador Hotel and the Sports Arena.

- An ASTME Center located in the Sports Arena will be in operation during all hours of the exhibit. Complete information and literature on all phases of Society operation will be available. ASTME supplies and publications normally sold during the year, to members and nonmembers, will be available for purchase.

- A ladies headquarters and lounge will be maintained throughout the conference in the Regency Room of the Ambassador Hotel.

- The following services will be available at the exhibit registration area in the Sports Arena:

Airline Desk—for purchasing tickets and confirming reservations on any airline.

Checking Facilities—for convenient luggage and parcel checking.

Message Center—for the conference visitor who expects to leave and receive personal messages.

monday, nov. 14

12 Noon . . . . . **California Day Luncheon**
A Tribute to West Coast Industry

Where: Concourse, Los Angeles Sports Arena.

Speaker: Maj Gen. Osmond J. Ritland, Commander, Air Force Ballistic Missile and Space Program, Air Research and Development Command.

Subject: "The Air Force Ballistic Missile and Space Program," with a film on vital aspects of recent space developments. Event will launch ASTME's five-day conference and exhibit.

Tickets: $5.50.

1 pm . . . . . **Exhibits open at Sports Arena**

2 pm . . . . . **Patio Party**
(See Ladies' Activities, Page 156.)

3-5 pm . . . . Technical Session: **Ceramic Cutting Tools Updated**

Where: West Venetian Room, Ambassador Hotel.

Chairman: Fred M. Wells, President and General Manager, Fred M. Wells, Inc.

"Physical Properties of Ceramic Tools and Their Relationships to Tool Performance" (Paper No. 303), by William Maxwell Wheildon, Jr., Senior Research Engineer, and Allan G. King, Research Engineer, Research and Development Dept., Norton Co.

"Aluminum Oxide vs. Carbide—Current and Future Applications" (Paper No. 304), by Andrew Schreiber, Sales Engineer-Administrator, Ceroc Tools, Vibro-Ceramics Div., Gulton Industries, Inc.

"Cutting Tool Comparisons at High Speeds" (Paper No. 305), by Dr. Donald R. Kibbey, Assistant Professor, and Harry D. Moore, Professor, Dept. of Industrial Engineering, The Ohio State University.

10 pm . . . . . **Exhibits close at Sports Arena**

Los Angeles Host Committee

Rudolph Regen	General Chairman
Lawrence D. Pomerantz	Executive Vice Chairman
John R. Bethune	Corresponding Secretary
James H. Medford	Financial Secretary
Alfred T. Rando	Coordinator, Technical Activities Division and Technical Sessions Chairman
Burton E. Belzer	Plant Tours Cochairman
Ralph Marsden	Plant Tours Cochairman
Ray Journeay	Transportation Chairman
Lincoln Mager	Emergency Cochairman
Henry K. Schierhold	Emergency Cochairman
Lawrence D. Pomerantz	Coordinator, Supplementary Activities Division
Harold Hammer	Reception Chairman
Robert A. Edgcomb	Publicity Cochairman
Frank A. Gonzales	Publicity Cochairman
Ralph Chrissie	Tickets Chairman
Barbara Journeay	Ladies Activities Cochairman
Jessie Vance	Ladies Activities Cochairman
John H. Stansbury	Host Committee Consultant
James R. Matthew	Chairman, National Program Committee

Registration Fees

IMPORTANT—Your conference and exhibit registration fee ($1 members—$2 nonmembers) also permits you to attend all technical sessions. In conjunction with the exhibit, 23 papers covering the latest developments in metalworking technology will be delivered by recognized experts during the course of 13 technical sessions. Published copies of each presentation are free of charge to those attending the technical sessions. The special registration fee for techtours includes the conference and exhibit fee:

NUMERICAL CONTROL TECHTOUR
$4.40 members . . . . . $6.50 nonmembers

POWDER METALLURGY TECHTOUR
$3 members . . . . . $4 nonmembers

tuesday, nov. 15

8 am.....Plant Tour: **AiResearch Mfg. Co.**
(See Page 157.)

9 am....**Techtour No. 1: Numerical Control**

Where: West Venetian Room, Ambassador Hotel.

(Note—Attendance limited to preregistrants. This is a multipart program of paper presentations; tours through Micro-Path, Inc.; Mechanical Specialties; Tools, Inc.; and a discussion period where all questions will be answered. Registration fees: $5.50 for members, $6.50 for nonmembers. Fees include all Techtour papers, distributed at the first session, a badge admitting registrant to the other technical sessions and exhibits at the Sports Arena, luncheon and round-trip bus transportation between the Ambassador Hotel and the three plants to be visited.)

Session A: 9 am (All sessions in West Venetian Room)

Chairman: Arthur F. Eskelin, Senior Research Engineer, Norair Div., Northrop Corp.

"Computer Programmed Machines in the Small Shop" (Paper No. 309), by Paul F. Fischer, Engineering Manager, Micro-Path, Inc.

"Tape-Controlled Turret Drilling: The Easy Way to Profits" (Paper No. 310), by Joseph L. Burg, Vice President of Sales and Engineering, Burg Tool and Mfg. Co., Inc.

"Use of Computers by Small Companies" (Paper No. 311), by G. A. Wesley, Sales Engineer, Bendix Computer Div., Western Regional Staff, Bendix Aviation Corp.

Session B: 11 am

Enroute to the plants to be toured, buses will stop for luncheon. Micro-Path, Inc., manufacturers of electronic systems of magnetic tape control for machine tools, will be visited. One of the high points will be their system of point-to-point and continuous path positioning control. At Mechanical Specialties, additional numerically controlled machines will be seen in operation. This company specializes in precision machining of complex parts, tooling, special machines and ground support equipment. At Tools, Inc., specialists in tools, dies, jigs and fixtures and jig grinding, visitors will see one of the finest jig bore facilities in the west, utilizing numerical tape control.

Session C: 4:30 pm

The morning speakers as well as representatives from the plants toured will be on the panel to answer all questions.

9:30 am.....Technical Session: **A Heat Treatable Machinable Carbide**

Where: East Venetian Room, Ambassador Hotel.

Chairman: J. Dickason, Vice President and General Manager, Metal Control Laboratories, Inc.

"Application of Steel-Bonded Carbide Tools for Metalworking" (Paper No. 306), by John L. Ellis, Vice President, and Stuart Tarkan, Production Manager, Sintercast Div., Chromalloy Corp.

"Physical Properties of Various Steel-Bonded Carbides" (Paper No. 314), by Martin Epner, Chief Metallurgist, Sintercast Div., Chromalloy Corp.

1 pm.....**Exhibits open at Sports Arena**

1 pm.....Plant Tour: **Douglas Aircraft Co.**
(See Page 157.)

1:30 pm.....Technical Session: **Metalcutting Breakthrough**

Where: East Venetian Room, Ambassador Hotel.

"Researches in Elevated Tenperature Machining of High Strength Materials" (Paper No. 307), by William Pentland, Assistant Professor of Mechanical Engineering, Sibley School of Mechanical Engineering, Cornell University; Jens Lennart Wennberg, Senior Research Engineer, and Clarence L. Mehl, Senior Research Engineer, Physical Research Dept., The Cincinnati Milling Machine Co.

"Relative Effect of Dry Cutting, Mist Cooling, and Flood Cooling on Nine Machinability Factors" (Paper No. 308), by Dr. Dimitri Kececioglu, Assistant to the Director of Mechanical Engineering, Industries Group, Allis-Chalmers Mfg. Co.; and Arthur Sorensen, Jr., Research Engineer, AC Spark Plug Div., General Motors Corp.

1:30 pm.....**Glitter Gazing Tour**
(See Ladies' Activities, Page 156.)

2 pm.....**Public Affairs Forum**
The Race for Manufacturing Supremacy—An Evaluation of Communist Manufacturing

Where: Conference Room, Chemistry-Geology Bldg., UCLA Campus.

Moderator: Walter Kassebohm, executive vice president, Marchant Calculator Co.

Panel: Nevin L. Bean, Staff Engineer, Ford Motor Co.; Robert Kudlich, Director of Computer Research and Development, AC Spark Plug Div., General Motors Corp.; Henry Noebels, Manager, Application Engineering, Scientific and Process Instrument Div., Beckman Instruments, Inc.; Edward E. Tuttle, Executive Vice President, Essick Mfg. Co.

10 pm.....**Exhibits close at Sports Arena**

wednesday, nov. 16

8 am.....Plant Tour: **North American Aviation, Inc.**
(See Page 157.)

9 am-5 pm.....**Board of Directors Semiannual Meeting**

Where: Embassy Room, Ambassador Hotel.

All members welcome to attend.

9 am....**Techtour No. 2: Powder Metallurgy**

Where: West Venetian Room, Ambassador Hotel

(Note—Attendance limited to preregistrants. This is a three-part program cosponsored by the Metal Powder Industries Federation. Registration fees: $3 for members, $4 for nonmembers. Fees include all techtour papers, distributed at the first session, a badge admitting registrants to the other technical sessions and exhibits at the Sports Arena and round-trip bus transportation between the Ambassador Hotel and Kwikset Locks.)

Session A: 9 am (All sessions in West Venetian Room.)

Chairman: Louie Boer, Senior Manufacturing Engineer, Borg Warner Controls Div., Borg Warner Corp.

"The Outlook for Powder Metallurgy" (Paper No. 322) by Kempton H. Roll, Executive Secretary, Metal Powder Industries Federation.

"Panel Discussion of Metal Powder Applications: (Paper No. 323), by Richard H. Khuen, General Manager, ASCO Sintering Corp.; Don M. Paullin, Pacific Sintered Metals Co.; Eugene Andreotti, Superintendent, Powdered Metals Dept., Kwikset Div., The American Hardware Corp.; and Ray B. Anderson, Jr., President, Ceromet, Inc.

Session B: 1 pm

This is a guided tour through the powder metallurgy production facilities of Kwikset Locks, Inc. This company, employing over 400 people, is recognized as a leader in the manufacturing of residential locksets.

Session C: 4 pm

The morning speakers will be on the panel to answer all questions.

9:30 am.....Technical Session: **Missiles and Metals**

Where: East Venetian Room, Ambassador Hotel.

"Falcon Ground Support Equipment Systems Test Concepts" (Paper No. 325), by Gordon E. Mathison, Assistant to the Department Manager, Support Equipment Dept., Engineering Div., Hughes Aircraft Co.

"Impact Extrusion: Is It Reaching Maturity?" (Paper No. 318), by Mark A. Ziegler, Staff Impact Project Engineer, Aluminum Company of America.

1 pm.....**Exhibits open at Sports Arena**

1 pm.....Plant Tour: **McCulloch Corp.**
(See Page 157.)

1 pm.....**Sunshine and Flowers**
(See Ladies' Activities, Page 156.)

1:30 pm.....Technical Session: **What's New in High Energy Rate Processes**

Where: East Venetian Room, Ambassador Hotel.

Chairman: Dr. Louis Zernow, Aerojet-General.

"High Energy Forming—New Manufacturing Techniques" (Paper No. 319), by Floyd Cox, Manager, Manufacturing Research and Development, Ryan Aeronautical Co.

"Newest High Energy Rate Processes" (Paper No. 320), by Fred A. Monahan, Manager, Applied Manufacturing Research and Process Development, Convair, a Division of General Dynamics Corp.

10 pm.....**Exhibits close at Sports Arena**

thursday, nov. 17

8 am....Plant Tour: **Crown Zellerbach Corp.**
(See Page 157.)

9 am-5 pm.....**Board of Directors Semiannual Meeting**

Where: Embassy Room, Ambassador Hotel.

All members welcome to attend.

9 am.....**Exhibits open at Sports Arena**

9 am.....Technical Session: **Producibility—Problems and Solutions**

Where: East Venetian Room, Ambassador Hotel.

Chairman: W. S. Fletcher, Vice President, Fletcher Aircraft Co.

"Chemical Milling—Solution to Producibility Problems in Temperature Resistant Air Frame Structures" (Paper No. 315), by Lew B. Stearns, Project Manager, United States Chemical Milling Corp.

"Designing Producible Air Frames from Super Alloys" (Paper No. 326), by Raymond G. McCue, Design Engineer, Design Producibility Dept., North American Aviation, Inc.

9:30 am.....Technical Session: **Processes of the Future**

Where: West Venetian Room, Ambassador Hotel.

Chairman: Richard S. Jensen, President and General Manager, Metallizing Co. of Los Angeles.

"Current and Future Uses for Electroforming" (Paper No. 321), by Bruce Chandler Jones, Chief Engineer, Allied Research & Engineering Div., Lytle Corp.

"The Plasmarc Coating Process" (Paper No. 316), by Harold V. Mosby, Sales Manager, Flame-Plating Dept., Linde Co., Div. of Union Carbide.

11:45 am.....**Western Bewitchery**
(See Ladies' Activities, Page 156.)

1 pm.Plant Tour: **Long Beach Naval Shipyard**
(See Page 157.)

2 pm.....Technical Session: **Precision Barrel Finishing**

Where: West Venetian Room, Ambassador Hotel.

Chairman: Jack Raskin, Vice President, L. H. Butcher Co., Inc.

"Techniques of Precision Barrel Finishing" (Paper No. 317), by Donald A. Mosher, President, BMT Mfg. Corp.

5 pm.....**Exhibits close at Sports Arena**

6:30 pm.....**Semiannual Dinner Party**

All members, visitors and their wives are invited.

Where: Embassy Room, Ambassador Hotel

Time: 6:30 pm, Social Hour
7:30 pm, Dinner

Entertainment: During social hour—Louise Haines and her accordion. Following dinner—Music for dancing and a floor show until 1 am.

Ticket Price: $8.50 (Refreshments optional.)

Honorary Sponsoring Committee of the 1960 ASTME Western Engineering Conference and Exhibit

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L. M. K. Boelter .....Dean and Chairman, Engineering Dept., University of California at Los Angeles.

friday, nov. 18

8 am.....Plant Tour: **Hufford Corp.**
(See Page 157.)

9 am.....**Exhibits open at Sports Arena**

9 am.....Technical Session:
Numerical Control and the Machine Tool

Where: West Venetian Room, Ambassador Hotel.

Chairman: J. L. Burg, Vice President and Sales Manager, Burg Tool Mfg. Co., Inc.

"Servomechanism Machine Tool Controls" (Paper No. 313), by Dr. Charles K. Taft, Chief Servo Engineer, The Warner & Swasey Co.

"Numerical Control Retrofit of Machine Tools" (Paper No. 312), by William B. Johnson, Industrial Engineer, Rocketdyne, Div. of North American Aviation, Inc.

10:30 am.....**Haunted Holiday**
(See Ladies' Activities, this page.)

5 pm.....**Exhibits close at Sports Arena**

Ladies Activities

Registration

Ladies may register with their husbands at the conference registration area on the lobby floor of the Ambassador Hotel.

Ladies Hospitality Room

The Regency Room of the Ambassador will serve as a gathering place for the ladies throughout the conference.

Patio Party

2-4 pm, Monday, Nov. 14

Initial get-acquainted party for the ladies. Tea will be served in the Dolphin Court of the Ambassador. Tickets complimentary.

Glitter Gazing Tour

1:30-4 pm, Tuesday, Nov. 15

Tour of Hollywood, including the Universal-International, Columbia and Disney studios. Tickets, $4.25.

Sunshine and Flowers

1-4:30 pm, Wednesday, Nov. 16

Tour of Descanso Gardens—the world's largest, with over 100,000 plants. Tickets, $1.25.

Western Bewitchery

11:45 am-2 pm, Tuesday, Nov. 17

A complete fashion show at Bullock's Wilshire, with dutch treat luncheon. Tickets, complimentary.

Haunted Holiday

10:30 am-2 pm, Friday, Nov. 18

Knott's Berry Farm, the famous Gold Rush Village and Ghost Town. Luncheon stop included, dutch treat. Tickets, $1.25.

Desert Delight

8:30 am-7 pm, Saturday, Nov. 19

A trip to Palm Springs for the entire family. Tickets, including transportation and lunch, $12.

plant tours

Tuesday, Nov. 15

Tour #1—8 am—AiResearch Mfg. Co. Buses depart from and return to the Ambassador. Limit 20 visitors. No cameras permitted. One of the world's largest aircraft and missile systems manufacturers, AiResearch makes about 1000 end products for almost every missile and aircraft produced today.

Tour #2—1 pm—Douglas Aircraft Co. Buses depart from and return (via Sports Arena) to the Ambassador. Limit 25 visitors. No cameras permitted. Visitors will tour the DC-8 jet liner assembly plant featuring flexible production lines. The facility consists of wide bays which make it possible to assemble the swept-wing as one complete unit.

Wednesday, Nov. 16

Tour #3—8 am—North American Aviation Inc. Buses depart from and return to the Ambassador. Limit 80 visitors. No cameras permitted. Tour will feature the manufacturing development program of the first all-steel airplane. Visitors will see boring and milling, numerically controlled equipment, quality control, fusion and resistance welding.

Tour #4—1 pm—McCulloch Corp. Buses depart from and return (via Sports Arena) to the Ambassador. Limit 80 visitors. The world's largest chain saw manufacturer, McCulloch also manufactures Scott outboard motors. Visitors will see modern manufacturing facilities involving die-cast operations and stamping operations with production up to 9 million parts per month.

Thursday, Nov. 17

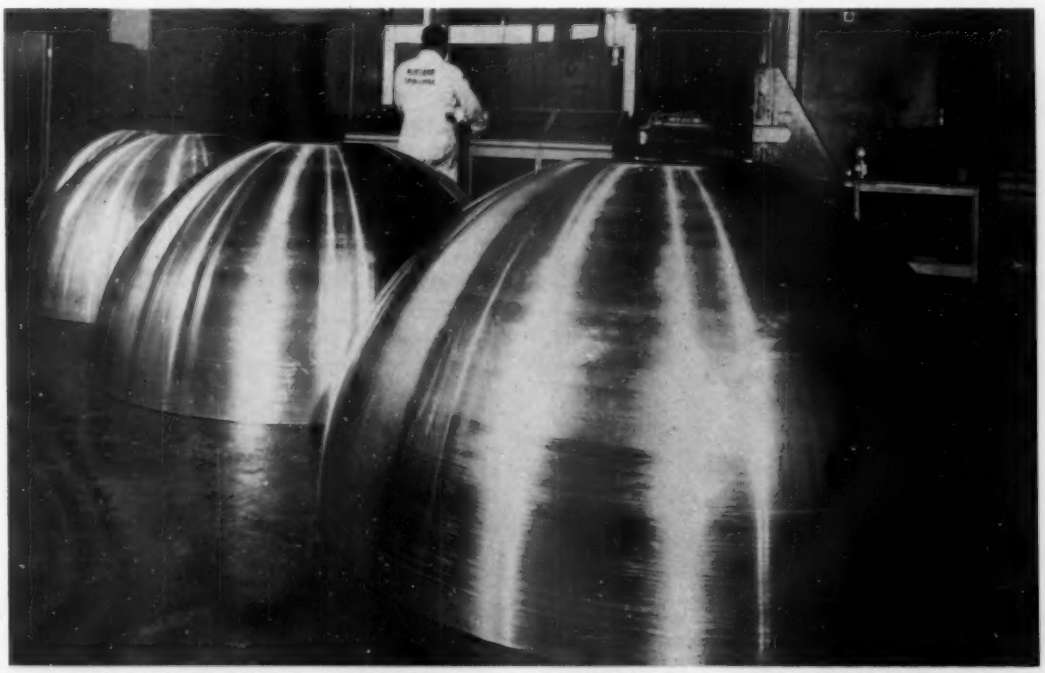
Tour #5—8 am—Crown Zellerbach Corp. Buses depart from and return to the Ambassador. Limit 80 visitors. The Los Angeles Div. of Crown Zellerbach Corp. is a manufacturing and warehousing operation serving the Southern California area. It produces toilet tissue, towels, napkins, grocery bags and tabulating cards. The plant has 348,000 square feet and is situated in the new industrial section of Los Angeles County recently incorporated as the city of Commerce.

Tour #6—1 pm—Long Beach Naval Shipyard. Buses depart from and return to the Ambassador. Limit 120 visitors. No cameras permitted. The yard provides logistic support—including drydocking, overhaul and conversion—for all vehicles of the fleet. The newest of the Navy's eleven shipyards, it employs the latest in modern equipment and techniques.

Friday, Nov. 18

Tour #7—8 am—Hufford Div. of Siegler Corp. Buses depart from and return (via Sports Arena) to the Ambassador. Limit 30 visitors. Tour includes the large machine tool division which fabricates stretch presses, Spin Forge machines and other special equipment designed by Hufford for production and ground support use. You will see stretch-forming, fabrication of electronic consoles for the Atlas Silo Launch program, and a movie-talk presentation followed by an on-the-job view of the 72-inch Hufford spin forge.

Round trip transportation is $1.75 per tour.



Los Angeles convention visitors on Plant Tour #7, the Hufford Div. of the Siegler Corp., will see spin-forging of 72-in hemispheres like these shown here. The completed missile domes are spun, like clay on a potter's wheel, from a 5086 aluminum dish 8 inches deep. Finished wall thickness is 0.150 in.; tolerance is 0.008. The Hufford plant, leading maker of stretch forming equipment, is at El Segundo, Calif.

chapter news



PETERBOROUGH, N. H.—Celebrating their completion of an intensive one-year course at New Hampshire Ball Bearings Technical School are seven Monadnock chapter student members (standing left to right): Kenneth Stockwell, Robert Morris, Arnold Baldwin, Ellen Wentworth, James Wheeler, Robert Boudrieau and Donald Daniels. Ellen is the three-year-old school's first coed. Assembled to congratulate the graduates are (seated left to right): Richard H. Cherwin, executive vice president of New Hampshire Ball Bearings Co. and member of Chapter 124; Arthur N. Daniels, president of the company; Sidney Doyle, director of education; and Donald Sutherland, director of personnel. ***—H. S. Humphrey, Jr.***

Home-Grown Talent Takes the Rostrum in Long Island

LONG ISLAND—"O Engineer, what does the boss require of thee! Only to define the unknown, to achieve the impossible and to walk humbly with thy fellow men." Paraphrasing words of the Old Testament prophet Micah, Ira Shur described to Chapter 88 the actual everyday requirements faced by the engineer.



Speakers of the evening at their own chapter meeting, these three members of Chapter 88 proved the effectiveness of home-grown talent. Left to right are: Richard Percy, welding engineer for Grumman Aircraft Engineering Corp.; Ira Shur, chief mechanical engineer for P. R. D. Electronics, Brooklyn; and Lawrence Wittman of Lawrence Wittman & Co., Copiague, N. Y.

Shur and two other speakers, Richard Percy and Lawrence Wittman, implemented at the chapter's first meeting of the year a new idea in program planning—drawing professional talent from within the chapter. The three speakers—all members of the Long Island group—left no doubt about the talent potential right in a chapter's own back yard.

Discussing "The Creative Process in Engineering," Shur, who is chief mechanical engineer for P. R. D. Electronics in Brooklyn, described the various stages in the creation of a product, starting with the original idea and going through to final production. "The greatest achievement of an engineer," he said, "is worthless to society (and this must be our yardstick of value) if it cannot be implemented. That is, it must be deliverable by him in some intelligible and useful form to the community of which he is a member."

"Man's primary basis for supremacy among the animals," he continued, "is his ability to think. This

ability to think, if it is not nurtured, properly directed and given the impetus to expand, is as useless as perfect vision in pitch darkness. It should, therefore, be an essential requisite of technical education that proper recognition be given to the attainment of this goal."

Shur went on to discuss the typical design problems brought to today's engineer. Given the problems, the engineer begins a creative process that may be divided into four phases: conception, practicalization, redesign to achieve esthetic satisfaction, and production. The end result is "an efficient, economical, salesworthy and profitable product."

Percy, who is welding engineer for Grumman Aircraft Engineering Corp., presented "A Historical Record of Steel Honeycomb Brazing." "Two years ago," he began, "the B-70 bomber program touched off the greatest manufacturing research and development program this country has ever seen. The reason for this mad scramble was the projected 20,000 sq ft of skin area on the giant plane, all of which was to be constructed of brazed honeycomb panels."

He then told how all the manufacturers in the country who were acquainted with this brazing process could not at that time produce even 10,000 sq ft of brazed honeycomb flat panel within a year. Subcontractors for the job agreed that separate braze furnaces would be required for each part number of the panel. Costs started to soar. Finally subcontracts were recalled and the B-70 was dead.

"And yet," Percy said, "what an airliner it would be—New York to Los Angeles in an hour and a half—and you could even put nuclear propulsion into it. It has plenty of stretch. Suddenly it was alive, this time with the General Accounting Office at the reins as it is today. . . . It is with this background that steel honeycomb brazing has been developing."

The balance of Percy's talk dealt with the types of brazing furnaces now being developed to help the B-70 program as well as future designs that will be coming off the drawing boards.

"The Role of ASTME in Plastics Manufacturing" was discussed by Wittman, a plastics manufacturer and chairman of Chapter 88's plastics section. He reported on the plastics section's initial program, a series of educational lectures for people in industry who work with or are interested in plastics, for teachers who desire to extend the scope of their technical knowledge and for interested students. Subjects of the lectures range from An Introduction to Plastics to Plastics as Engineering Materials. The sessions feature guest speakers whose presentations include sound films, slides, sample materials and actual working demonstrations.

At this meeting Chapter 88 elected John Miller treasurer. He replaces Nat Crimi who, for business reasons, was forced to resign. Don Spetta will take over Miller's former duties as secretary.

—Henry MacDonald

special events

Mississippi ASTME Chapter Second Annual On-Campus Conference	Nov. 3, 1960	Mississippi State Univ. State College, Miss.
ASTME Semiannual Meeting	Nov. 14-18, 1960	Ambassador Hotel Los Angeles, Calif.
ASTME Western Tool Show	Nov. 14-18, 1960	Memorial Sports Arena Los Angeles, Calif.
ASTME 29th Annual Meeting	May 20-26, 1961	Statler Hilton Hotel, New York City
ASTME 1961 Tool Show	May 22-26, 1961	New York Coliseum, New York City

Chapter 134 Sponsors Winning Junior Achievement Company



Holding the second-place trophy for Junior Achievement company of the year is James Marcero, president of the winning company, which was sponsored by Chapter 134. Lou Bogden (left) and Carl Mourning were advisers for Marcero's company.

LORAIN COUNTY — Working with the leaders of tomorrow in their community has given members of Chapter 134 plenty of reason to be proud.

It all started last fall when the chapter decided to sponsor a Junior Achievement company. They were the first organization in the Lorain County area to undertake such a project. Now the ASTME-sponsored company has come through with flying colors to receive the trophy for the second-best Junior Achievement company of the year.

Named Asterjacs, the company was composed of 19 high school juniors and seniors. The group sold stock to organize the company, purchased material, produced a product and sold the product to the public. After liquidation, the company paid each stockholder the full purchase price of his stock plus a 10 percent dividend—and still made $75 profit.

James Marcero, president of Asterjacs Co., won

two $100 scholarships on the basis of his salesmanship and received a pin and certificate for being one of the two best executives of the year.

Chapter members who served as advisers for the trophy-taking company were: Warren Sturtevant, Lou Bogden and Carl Mourning. —*Carl Mourning*

Chapter 71 Tours Pump Plant

CEDAR RAPIDS—Chapter 71 members recently toured the Viking Pump Co. in Cedar Falls, Iowa. The originator of the "gear-within-a-gear" rotary pump, Viking has developed a complete line of rotary pumps, ranging in capacity from ½ to 1050 gallons per minute. Among other types, members saw the self-priming positive displacement pump that is used by various industries from foods to crude oil.

The group toured the buildings used for the various machinery operations of the pump and, in addition, Viking's gray iron foundry, alloy foundry and research laboratory.

Oak Ridge Member Dies

OAK RIDGE, Tenn.—William L. Blackford, supervisor of the Union Carbide Nuclear Co. in Oak Ridge, died recently. He was a member of Knoxville-Oak Ridge Chapter 107.



WINDSOR, Ont.—Chairman F. D. Rail (left) of Windsor Chapter 55 has resigned his chapter post for the balance of the 1960-61 term following a new appointment with the Ford Motor Co. in Australia. Rail will be in Australia in time to officiate at the chartering of that country's third ASTME chapter, at Adelaide, on Nov. 11. First Vice Chairman R. Smith will assume the chairmanship of Windsor chapter for the rest of the year.

Conrad Represents Society At ASM's Dedication

CLEVELAND—The new national headquarters building of the American Society for Metals, a modernistic crescent of offices under a spectacular geodesic dome of aluminum, was formally dedicated in ceremonies at suburban Metals Park on Sept. 14. Dr. Clyde Williams, former president of Battelle Memorial Institute, gave the dedication address.

Representing ASTME at the day-long ceremonies was Executive Secretary Harry E. Conrad. ASM's managing director is Allan Ray Putnam, formerly Conrad's assistant at ASTME's Detroit headquarters.

Educator-Engineer Tells of Safety in Die Design

INDIANAPOLIS — Approximately half of the presses in this nation are not guarded with pullbacks, sweeps and other safety devices, yet more accidents occur on the guarded presses than on the unguarded. With this amazing statistic Stanley R. Cope impressed upon his Indianapolis chapter audience the importance of his theme, "Safety in Die Design."



Stanley R. Cope, a past chapter chairman of ASTME, who recently spoke to Chapter 37 on die design safety, displays a metal stamping produced by a die. Watching attentively are (left to right) Clarence Myers, Indianapolis program chairman; Arthur Love, manufacturing engineer at Progress Tool & Engr. Co.; and Stanley Moore, Cope's assistant.

Cope, who spoke at a recent meeting of Chapter 37, is the originator of the Cope System for Training Tool Engineers and the founder of the first school to offer specialized training in tool and die designing. A past chapter chairman of ASTME, he is nationally known for his technical writings, lectures and consulting work in the metalworking industries.

In comparing British and American safety rules with regard to stamping plants, Cope noted that Britain has added some stringent laws which have reduced their accident rate by more than 50 percent. For example, if a finger or hand loss occurs, the British plant involved is closed completely for two to four weeks and management is heavily fined.

The whole die, of course, is dangerous, but Cope advocates a three-zone method for checking a design for safety. Danger zone No. 1 is the die's nominal center area and the actual steels that cut, form or work. Danger zone No. 2 is at the left and right-hand ends of the stripper plates and pressure pads; here, finger and thumb clearance should always exist

because the ends of the stamping may be formed up or down at these points. Danger zone No. 3 includes leader pins, sliding pilots, cam blocks and scrap cutters.

Before closing his talk, Cope pointed out that the die designer does not bear all the responsibility for promoting safety. The diemaker, by deviating from the design, can also cause injuries.

The same evening Chapter 37 installed six new members. —*James J. Denney*

"Don't Machine 'em, Cast 'em!" Says Chapter 11 Speaker

TWIN CITIES — Describing the scope and cost reduction possibilities of Cerrotechnics, O. J. Seeds, manager of the Alloy Dept. of Cerro de Pasco Sales Corp., gave this advice at a Twin Cities chapter technical meeting: "Don't machine 'em, cast 'em!"

The raw materials of Cerrotechnics — zinc, lead, copper, bismuth, cadmium, selenium, thorium, tellurium, silver and gold — are produced in the Cerro de Pasco mines, said Seeds. In the mining operation, zinc, lead and copper are the major products and the others are byproducts.

The alloys of these metals melt at relatively low temperatures. For example, the lowest melting member of the family, Cerrolow 117, melts at 117 F; and the highest melting member, Cerrocast, has a melting range of 281 to 338 F.

Because of their low melting points and their predictable coefficient of expansion upon solidification, Cerro alloys can produce cost reductions in many areas of use. Seeds enumerated these as: (1) Anchoring parts in assemblies, such as bearings, bushings and nonmoving parts in machinery; (2) making chucks for holding irregularly shaped workpieces during machining or for special operations like gem cutting; (3) making cores for patterns such as those in foundry match plates; (4) making dies and punches for short runs in blanking, piercing and trimming and making form blocks for bending, forming and joggling extruded shapes, sheet metal and tubing; (5) making molds for such purposes as holding and forming fiberglass laminates or casting plastics. —*Ed Gillaspy*

Post Office Bans Chapter Bulletin

LITTLE ROCK, Ark.—Chapter 123's bulletin is a bright idea any way you look at it.

The Little Rock Post Office thinks the bulletin's brilliant, glow-in-the-dark red cover is literally too bright to handle. Addresses written on it are difficult to read and it hurts the postal clerks' eyes, said a Post Office spokesman. The chapter was instructed that after its present supply of covers is used, no more of these eye-catchers can be sent via the mail.

Sentenced by the postal authorities, the glowing red bulletin proved to be pretty brilliant publicity for Chapter 123. Cleverly, the story was withheld until fall programs began. When it was released by chapter members Bill Hill, David Finney and Bud Spires, it not only made the national news, but appeared in local newspapers along with notice of a chapter meeting and plant tour. The outcome was the signing of six new chapter members and a large turnout for both the meeting and the tour.

Reports in Brief . . .

Leonard P. Hartung, program chairman of the southern Tier Navy League, who took part in the Navy's Fleet Ballistic Missile program while on active duty, spoke to the ITHACA chapter on the 1500-mile Polaris missile. He outlined the country's defense plans to make ready by next year 2500-mile-range missiles and 21 nuclear-powered submarines.

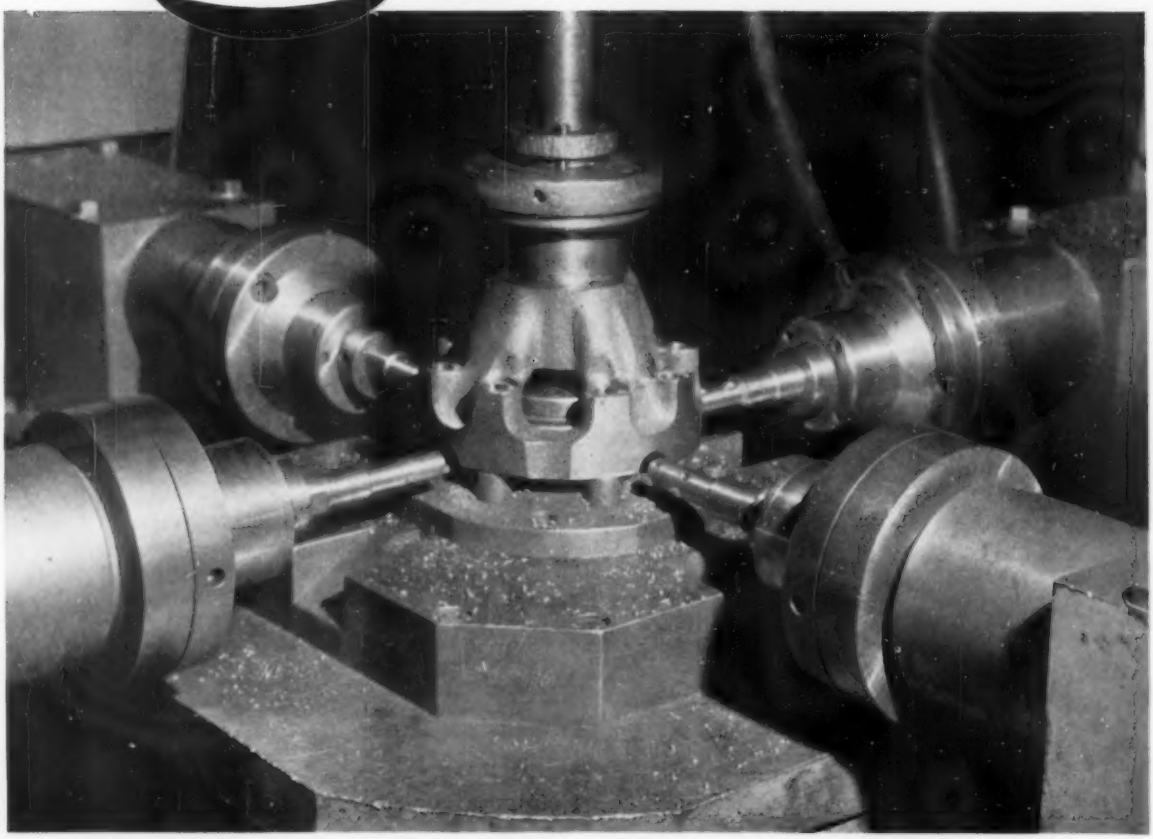
A few minutes analysis of the drilling operation and a careful selection of the proper drill will result in higher production per grind and less cost per hole, cautioned Arthur A. O'Sickey of Standard Tool Co. when he spoke at a recent meeting of BOSTON Chapter 33. He cited several instances of proper drill selection, such as using a heavy web drill on hard and tough-to-machine materials.

NASHVILLE chapter members were informed on patent law and procedures by Harrington A. Lackey, a Nashville patent attorney who spoke at the regular chapter meeting. Lackey distributed a pamphlet on the "What, Why and How of Patents."

Joe Bosi, chief engineer at Hydro-Line Manufacturing, Rockford, Ill., presented a speech and demonstration on air and hydraulic cylinders at the MACOMB chapter meeting. The demonstration showed misalignment causing excessive cylinder wear.

ALBUQUERQUE chapter members recently heard Harry Conn, chief engineer for Scully-Jones & Co., Chicago, talk on the "Economic Effect of Modern Tooling." Conn covered new tools and tooling concepts such as automatic tool changing, quick-change tooling and preset tooling. He evaluated, analyzed and explained safe-torque tapping.

VR-65 Tungsten-Free Carbide



4 times more production!

The job is rough and finish boring half holes in a C5 steel forging. The machine is a 4 way Cross Bore operating at a speed of 2360 rpm and 700 sfpm; with a feed of .005 and a .025 to .030 depth of cut.

VR-65 tips are brazed to boring tools by conventional methods.

On this interrupted cut, VR-65 produced from 80 to 100 pieces per grind as compared to 10 to 25 pieces by previous conventional tungsten-base carbides.

VR-65 is the first of a new generation of carbides to provide ultra high speed machining on *all* types of steel . . . see your V-R representative for details or write:

CREATING THE METALS THAT SHAPE THE FUTURE

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Progress in Production

STEEL-RULE DIES CUT TIME AND COSTS

Used in blanking metals such as steel, aluminum and titanium, steel-rule dies are prepared in from one-fourth to one-half the time required to produce conventional dies, and with savings up to 80 percent. At Chance Vought Aircraft, Inc. they have saved more than $50,000 in man-hours this year.

Produced with steel-rule dies, a small titanium panel of more than 1585 parts is blanked and pierced in a single operation, as opposed to the multiple operations formerly required. On a



Upper and lower sections of steel-rule die built of available shop materials.

medium-sized piece of titanium the new process saves 20.47 man-minutes.

The steel-rule method uses a wood-metal die set. The die is built of tempered steel, sawed to the exact punch contour and then ground for clearance. The punch is flat steel-rule stock, shaped to the form of the finished product and inserted in a wooden form for support. Punches, as required for holes or unusual openings, are also inserted within the area of the steel cutting band. The dies are set in a punch press and used to blank the desired material at pressures up to 600 tons, depending upon the toughness of the material being blanked.

CIRCULAR MACHINE DRILLS, REAMS, COUNTERBORES, TAPS

The solution to a handling problem posed by workpieces, a new rotary type machine built by National Automatic Tool Co., Inc., performs all drilling, reaming, counterboring and tapping operations on two different flywheels. The core of the machine is a seven-position rotary table surrounded by six machining units and one loading and unloading station.

Each flywheel is fastened vertically against the table side by a precision collet that expands through the center hole in the flywheel. As the table indexes, multiple and single-spindle drill units advance and drill 40 holes, ream 14 holes and counterbore and tap six holes. Chips are automatically swept into an underfloor conveyor by a brush moving with the turntable.



Operator is controlling six machining and one loading station by pushbutton.

MODERN PRESS AND DIES CUT COSTS IN HALF

Magnavox Co. is now manufacturing loudspeaker cone housings at a 50 percent reduction in per part cost and a 600 percent direct labor saving, due to a press and die modernization program developed by five production engineers.

Formerly the housings were manufactured on seven 200-ton straight-side



Press in operation is running 4 x 8-inch loudspeaker conehousings.

presses with seven individual single-stage dies. Seven operators hand fed parts that were transported by chute and belt conveyor from press to press. Production averaged 625 parts per hour.

The new production process revolves around one 300-ton Minster two-point straight-side press equipped with five to seven-stage progressive dies. The double-geared press has automatic feed equipment, an 84 x 48-inch bed and is capable of 25 to 50 spm. In this press, housings ranging from 3 to 6 x 9 inches in size are automatically and progressively produced from coil stock to finished part. One operator is required and production averages 1800 finished parts per hour.

Direct cost reductions gained by the new stamping process include a 20 to 30 percent material saving, a 75 percent reduction in die setup time, 90 percent less die maintenance and a substantial saving from the use of older presses to produce parts formerly pur-

chased outside. The expense of the new press and progressive tooling will be offset during the first 20 months of operation.

POSITIONING CONTROL SYSTEM IS ACCURATE AND VERSATILE

Having accuracy to ±0.001 inch and repeat accuracy to ±0.0005 inch, Square D Co.'s point-to-point positioning control system, the Rapac, operates with virtually any machine tool or device requiring accurate positioning. It is suitable for multiple-axis control and uses punched tape for predetermining sequences.

The Rapac linear transducer indicates the direction of travel toward the desired positioning point at all times. Cyclical transition from one measuring scale to the other, present in synchros and other systems, is eliminated.

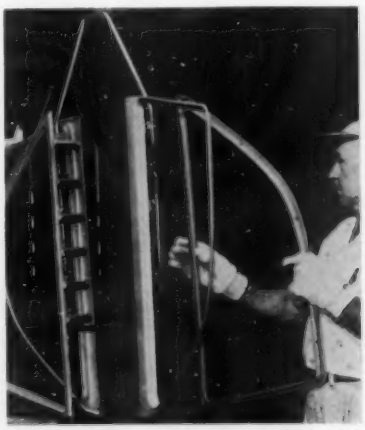
Static components and encapsulated build-block circuitry—used wherever possible—reduce and simplify maintenance. The system is available as a complete unit, or in components for measuring subsystems, drive subsystems and data-decoding subsystems. These components include Type A-S adjustable-speed drive, linear transducer, phase detector, command transformer, power supply and Norpak static decoding system.



Point-to-point positioning control system gets final inspection.

MAGNETIC "MOBILE" SPEEDS PARTS HANDLING

With 24 permanent magnets, a rectangular frame supports parts ranging in size from small moldings to 36-lb floor pans on any point of contact. In use, the magnetic rack looks like a modern art mobile, but it is actually an effective replacement for pins, clamps and hooks on conveyor lines through paint operations at Chrysler Corp. assembly plants.



Magnetic rack supports varied-sized parts through paint operations.

Parts now handled by the magnets formerly required 77 different styles of hangers. Hanging the parts on the rack is quicker than threading them



FERRO-TIC combines the fabricating advantages of steel with the wear-resistance of carbide. In the annealed, completely dense state, **FERRO-TIC** can be machined with high-speed tools on conventional tool room equipment; thus, the need for costly diamond grinding is eliminated. Once hardened, by oil quenching from 1750°F, **FERRO-TIC** is extremely hard and wear-resistant. **FERRO-TIC** stock blanks can be fabricated into long-wearing components, using available tools and skill without delay! **FERRO-TIC** is ideal for: Blanking, Lamination, Deep Drawing and Heading Dies, Arbors, Core Rods, Wear Parts, etc. **FERRO-TIC** can be turned, drilled, milled, sawed, tapped . . .

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onto a hanger, placing them on a hook or slipping them inside a clamp. The magnets handle up to 38,000 parts per day in each assembly plant.

DRILL PRESS BEATS SWAGING TOOL'S TIME

Swaging nearly 250 oil-cooler tube ends per hour, a standard 17-inch Delta drill press at United Air Lines' Engineering and Maintenance Base is swaging at twice the rate of a portable swaging tool.



Drill press is swaging oil-cooler tube.

A simple block casting, bored to fit the drill-press column and added between the drill head and motor, permits the spindle to reach any point on the face of the cooler. A long belt makes possible the 9-inch extension of the drill-press-throat capacity.

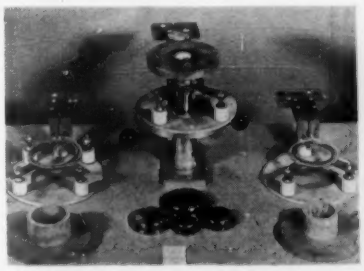
WORK-COILS BRAZE MULTISIZED ASSEMBLIES ON ONE HOLDING DEVICE

By using various-sized two-turn work coils and special adapters, Induction Heating Corp. is brazing different-sized work assemblies on a single holding fixture.

The workpiece is composed of a preformed silver alloy ring and a brass sleeve with an undercut at one end. The undercut end of the sleeve is press fitted into the ring. Flux is used on the assembly to insure cleanliness of the joint area.

A work-coil and adapter, suited in size to the workpiece, are mounted into place on the holding fixture. Three bolts tighten the coil assembly to the fixture body. The center of the adapter fits around the clamp's elevating pin, and the outside diameter of the adapter fits the dimensions of the workpiece. The elevating pin is raised to load the workpiece, then lowered with a control knob and locked with a clamp knob. The induction coils are energized for an automatic time cycle when a heat button on the work-station panel of a 25-kw generator is pressed. One minute is the maximum brazing time needed for even the largest work assembly.

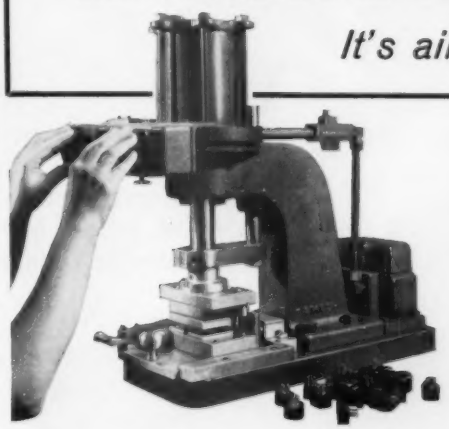
This procedure is reversed for the interchange of work-coils. Change-over to different-sized sleeves requires the removal of four bolts at the lead blocks of the mounting and three screws in the base plate. For vertical adjustments, the multisized coil-turns are supported on insulators with stud inserts.



Work-coils, adapter and workpiece are mounted on holding fixture (center).

Solve your "Small Parts" production problems with a **HANNIFIN "HAN-D-PRESS"**

It's air operated!



The husky Hannifin "Han-D-Press" takes operator fatigue out of light production operations where speed is the key to economy. A safe, easy-to-operate Hannifin air-operated bench press can handle these sometimes troublesome jobs better, faster and easier.

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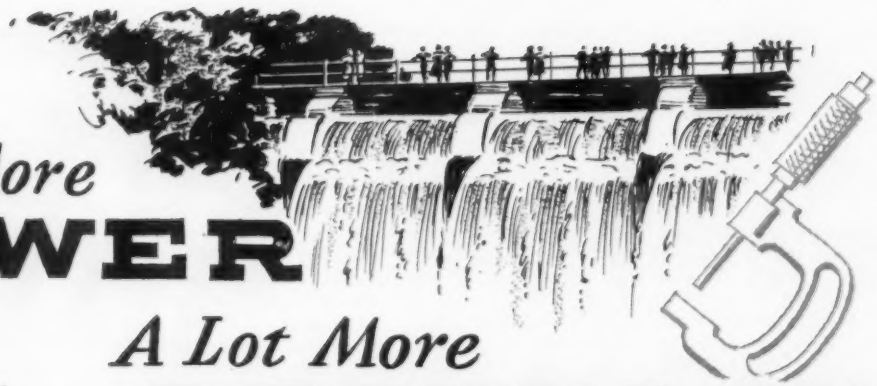
- Electric control through Hannifin 4-way solenoid-actuated valve.
- Guided ram. Speed easily adjustable. Automatic return.
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- Minimum maintenance. Rigid frame; cylinder "trubored" and honed.
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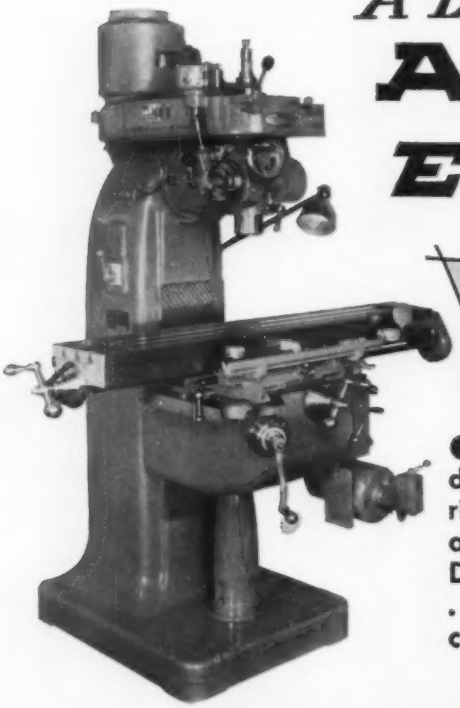
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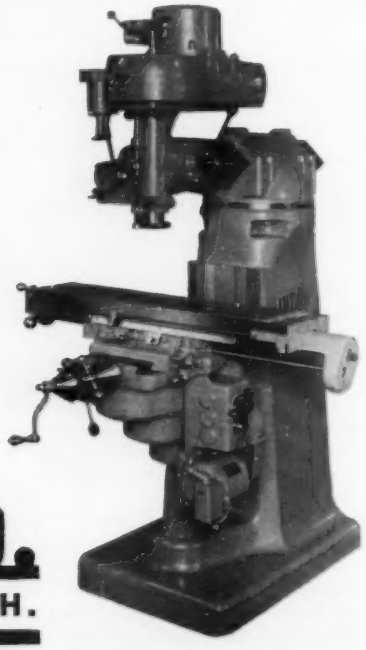


INDEX "SUPER 55" VERTICAL MILL

● 1½ HP Head or optional 2 HP with continuous duty motor gives 50% or more capacity . . . More rigidity, more accuracy . . . Increased horse power and dynamically balanced Cast Iron Pulleys and Drive System afford improved production capacity . . . More weight in the column, heavier ribbed column, heavier knee, heavier saddle.

INDEX "45" VERTICAL MILL

● Unique square design of overarm affords more rigidity, greater accuracy . . . Provides extra range and capacity . . . More power at the cutter. No adjustment required on overarm and head after use . . . No need to re-indicate head after moving overarm . . . Speed range with nine changes makes possible the use of high speed or carbide tipped cutters to best advantage.

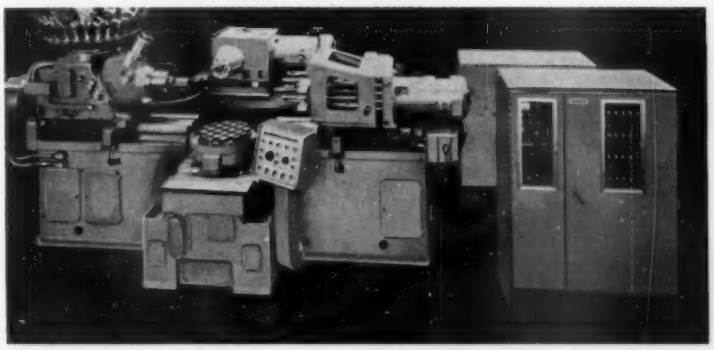


INDEX MACHINE CO.

539 N. MECHANIC ST., JACKSON, MICH.

TOOLS of today

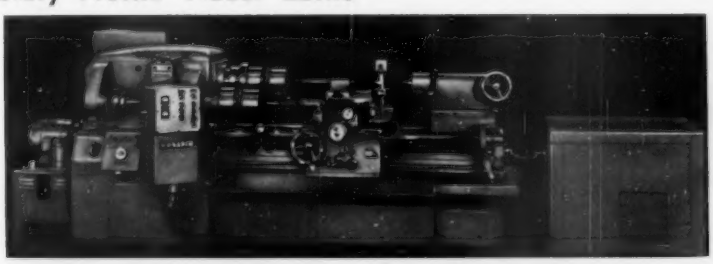
Tape-Controlled "Machining Center"



Parts that require face and other milling cuts plus drilling, boring, reaming and tapping operations can be machined on the MT-3 machining center. The machine has three stations with 5 to 7½-hp independent spindle drive motors. Designed on the building-block principle, it has a central positioning table surrounded by three tape-controlled work heads: a universal drilling, tapping and boring head with a storage capacity for 30 tools; a face milling head; and either a multiple-spindle drill head or a boring head with a 14-tool-capacity changer. The machine is well-suited for lot quantities of 5 to 500 parts.

Hughes Aircraft Co., P. O. Box 90904, Airport Station, Los Angeles 45, Calif. **Circle 501**

Rotary Profile Tracer Lathe

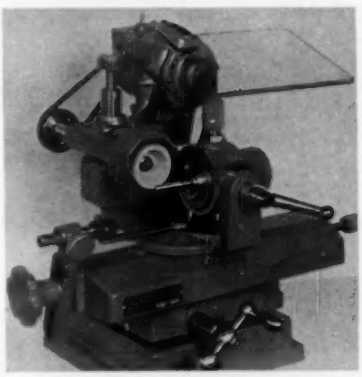


The 612 rotary profile tracer lathe was developed primarily for the boring of bottle molds having a noncircular cross section. Other applications include the machining of plastic molds, aircraft parts, cams and rotors and conventional turning, boring and threading. It incorporates an electro-hydraulic tracer which has a stylus deflection pressure of 1½ oz. The maximum tracer slide stroke at one setting is four inches.

Monarch Machine Tool Co., Sidney, Ohio. **Circle 502**

Router Bit Grinder

Carbide and high-speed steel router bits, having either straight or tapered flutes, can be sharpened with the Model RB-2 router bit grinder. It incorporates a 12-division, rapid indexing work head rotating on sealed ball bearings and provided with a reversible index mechanism. Designed to accommodate router bits with 1, 2, 3, 4, 6 and 12 flutes, the work head swivels 90 deg so that the sides and ends can be sharpened in one setup. Grinding wheels are mechanically dressed with an adjustable diamond dresser attached



to the carriage. The carriage has a 4½-inch longitudinal travel and rolls in antifriction ways. Collet capacity is ¾ inch and the work head swing is three inches.

William H. Field Co., Inc., Boston, Mass. **Circle 503**

Blow Molding Machines

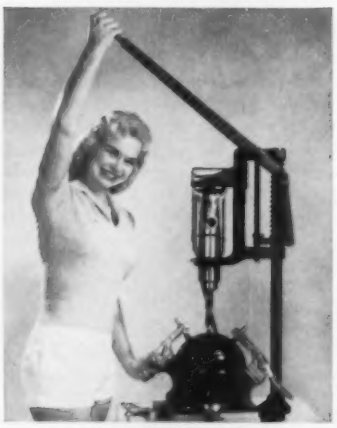
Smooth, cushioned mold closing is attained by the two-stage hydraulic system of the Atlas blow-molding machine. In the first stage, a low-pressure pump closes the mold to the last ½ inch of platen travel and, to

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No matter what the size or shape, when you need constant, accurate holding power, the sturdy "clamp-ability" of De-Sta-Co Toggle Clamps is the answer.

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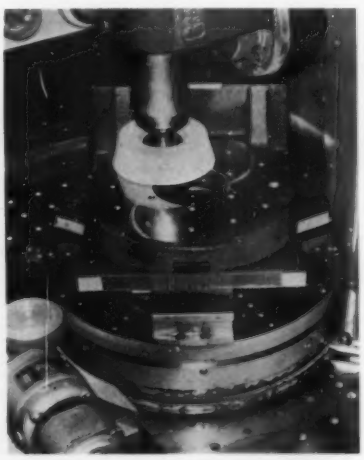
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complete the second stage, a high-pressure pump applies clamping pressure. Movable platens are guided by alloy-steel tie bars with roller bearings. Platen and mold weight are carried by bottom-mounted ball-bearing wheels riding on hardened and ground ways, which relieves the tie bars of their load-carrying function. Each platen may be adjusted four inches to accommodate larger parts or the platens may be adjusted to shorten travel. Machine height is also adjustable.

Peuchen Engineering Corp., Basin Road, Wilmington 4, Del. **Circle 504**

Rotary Table

Applications for the Ultraron rotary table, which has runout and parallelism accuracy of 0.000005 inch, include inspection, grinding and lapping operations where concentricity, squareness and parallelism are important. The table consists of three major components: a heavy steel base, a matched



set of steel balls and a revolving top plate with tapped mounting holes. Table sizes range from 6 to 96 inches in diameter.

Gage Co., 350 Fair St., Detroit 20, Mich. **Circle 505**

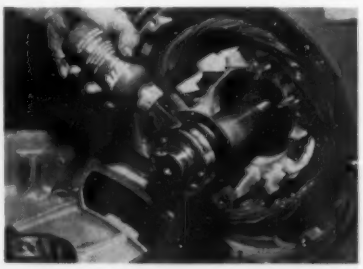
Vane Pumps

The TIC series vane pumps are designed for continuous operation at pressures up to 2500 psi and at speeds to 2500 rpm. Employing a balanced vane, floating cartridge construction and internal drainage, they are available in four models of 8, 11, 14 and 17-gpm.

Denison Engineering Div., American Brake Shoe Co. **Circle 506**

Plastic Sealant

The Locktite sealant being applied to the outside diameter of this loose bearing will restore the fit by hardening and filling the clearance between the bearing and the housing. A thin liquid plastic, the sealant hardens when confined between closely fitting metal



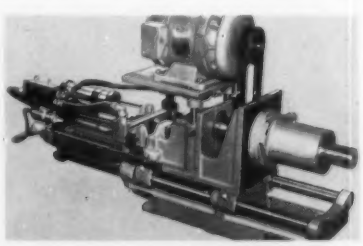
parts. When it is drawn into the threads between nuts and bolts, the catalytic action of the metal surfaces causes the sealant to harden automatically and lock the parts together. Parts will not loosen from vibration, but can be removed with ordinary tools.

American Sealants Co., Hartford 6, Conn. **Circle 507**

Drilling Units

Bellows-Valvair Carbi-Drill series of heavy-duty drilling units has adjustable controlled air-power advance and retract and adjustable hydraulic feed. On the gun drill unit, a high-pressure rotary coupling delivers coolant through the spindle and drill into the work, permitting accurate deep-hole drilling in virtually any material. It has a drill capacity to ½ inch and an 8-inch stroke over steel slide rails.

Having the same stroke as the gun drill unit, a single-spindle unit operates at lower rpm, does not have the coolant feature and handles ordinary drilling operations to ⅞ inch. A twin-drill unit has planetary heads, allowing two holes

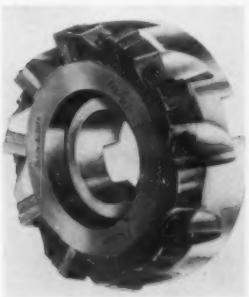


up to ⅝-inch diam, with hole centers ranging from 2½ to 9½ inches, to be drilled on any plane within 360 deg. A boring unit has a 4-inch stroke, runout not over 0.001 inch TIR and a ⅝-inch drill capacity.

Bellows-Valvair. **Circle 508**

Milling Cutter For Throwaway Inserts

Carbide chip deflectors, carbide anvils and throwaway carbide inserts are incorporated in the Dex-A-Mill face and shell end milling cutter. Inserts are easily locked, unlocked, indexed or replaced in the two-piece body con-



struction with the cutter in position. Each insert has eight individual cutting edges. The cutters are available in face mill and shell end mill designs, with double negative rake angles and 150-deg lead angle in standard diameters from 3 to 12 inches.

Adamas Carbide Corp., Kenilworth, N. Y. **Circle 509**

Notching and Slotting Device

Two pipes or tubes can be double-notched at one end stimultaneously or one pipe or tube can be double-notched at both ends in a single press stroke with the No. 102 Arc-Twin Tandem. The unit can also make various slottings such as the T, flared or long, narrow types.

Vogel Tool & Die Corp., 1825 N. 32nd St., Stone Park, Ill. **Circle 510**

Recess Toolholder

Designed for tape-controlled or automatic machines which normally have



confined areas for tool changes and storage, this recess toolholder features a shortened working section. Two sizes are available—No. 1-RA having a working range from ⅛ to 1-inch diam and a travel of 9/32 inch and No. 2-RA having a working range of 1 to 2-inch diam and 5/16-inch travel. The feedout of the cutter is in ratio of 1:1 to the spindle. This holder can use circular form cutters—high-speed steel or carbide—or bit type cutters. It incorporates gear-and-rack actuation, a ball-bearing pilot and plastic and rubber bellows.

Maxwell Industries, Inc., 493 E. 5th St., Ashtabula, Ohio. **Circle 511**

Welding Gun and Wire Feeder

This air-cooled push type welding gun and wire feeder can be used for buried arc welding and spray arc welding with carbon dioxide as a shielding gas or for standard gas-shielded metal-arc welding with argon as a shielding



gas. The gun, Model AH60-B, has a 60-deg gooseneck nozzle assembly and a lever type trigger.

The feeder, Model AHF-D, can be used with either constant arc voltage or Fillerarc motor generator power sources. It includes a remote speed control with 15 feet of service cord to provide wire feed speed adjustment up to 600 ipm near the work.

Air Reduction Co., Inc., 150 E. 42nd St., New York 17, N. Y. **Circle 512**

Index Table Drive

Designed with an open center, the T-X-10A cam drive can be used to index tables which will experience high thrust and radial loading conditions. It has a follower plate thrust rating

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of over 31,000 lb and a tipping moment rating of 380,000 in-lb. Mounted around the periphery of the follower plate is an "X" bearing which allows an opening in the index unit of 7¾ inches for utility connections or an 8½-inch diam opening for stationary center column machine applications. These drives are available with integral gear reducer for use on tables ranging in size from 20 to 120 inches in diameter.

Expert Automation Machine Co., 17144 Mt. Elliott Ave., Detroit 12, Mich. **Circle 513**

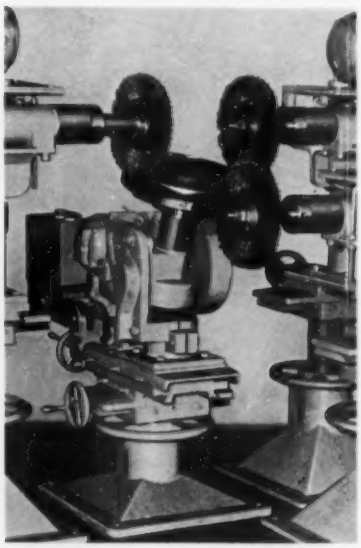
Bandsaw Blade

Alloy Band, a double carbide alloy bandsaw blade, is especially designed for standard cutoff saw machines. The range of materials that can be cut with this band includes many of the tougher alloy steels.

L. S. Starrett Co., Athol, Mass. **Circle 514**

Deburring Machine

This Acme semiautomatic machine is designed for finishing circular or related shaped parts. It consists of an adjustable single-spindle Acme Type B-61 semiautomatic machine that positions and rotates the parts and Acme L-8-L adjustable lathes positioned around the machine to perform the deburring operations. The spindle can

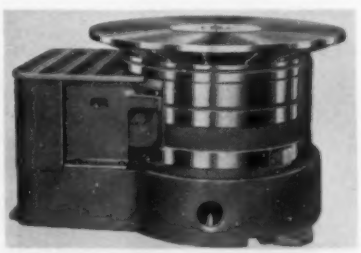


be tilted in any direction and pivoted in a 360-deg arc to permit easy location of the part with respect to the lathes. The lathes are driven by a 5 or 7½-hp motor. Spindle speeds range from 1000 to 2100 rpm.

Acme Mfg. Co., 1400 E. Nine Mile Rd., Detroit 20, Mich. **Circle 515**

Indexing Machine Chassis

The Series H turret indexing machine chassis provides intermittent motion for multiple-station automatic assembly operations. The chassis is



available with a wide selection of speeds, turret diameters of 48 to 72 inches, and 6 to 32 work stations. It is designed with an extension of the main index camshaft which allows mounting of operational cams to actuate tooling

"The No. 3's split the tenths!"

So report users of Moore's New Jig Borer and Jig Grinder



"Our operators feel that these are the best machines they have ever worked on. They take care of the tenth-splitting tolerances required by industry today. Over the years we have enlarged our Moore Jig Boring and Jig Grinding Department to 15 machines." These are the words of Herbert Harig, President (left above), and Karl Harig, Chairman (at right), Harig Manufacturing Corporation, Chicago, Illinois.



You will easily break the "tenth" barrier with this accurate machine. No gibs...no overhang...improved drive ...speed range of 60 to 2250 RPM...11 x 24" table working surface. It bores, drills, reams and spots holes in dies, jigs and production parts with unequalled speed and accuracy.



With this new, larger No. 3 model, you can grind—*with split-tenth* accuracy—holes plus regular and irregular contours to size and location after hardening. Faster strokes are provided for chop-grinding ... infinite spindle speeds, 40 to 250 RPM...larger table working surface, 11 x 24".

All hardened, ground and lapped ways. Made and calibrated to the new international inch.

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Among the highly skilled toolroom operators in the Federal Products Corporation, Providence, Rhode Island, is this talented jig grinder operator, Mrs. Florence Smith. Mrs. Smith achieves ultra-precise results with the No. 3 Moore Jig Grinder.



"We have found that it costs real dollars and cents to operate without Moore equipment. This cost factor is just one of many reasons why we recently added the new Moore Model No. 3 Jig Grinder. This Machine, with its tenth-splitting accuracy, hardened ways and wider range, enables us to service more customers better." Statement by Val Koller, President, Koller Die & Tool Co., Milwaukee, Wisconsin.



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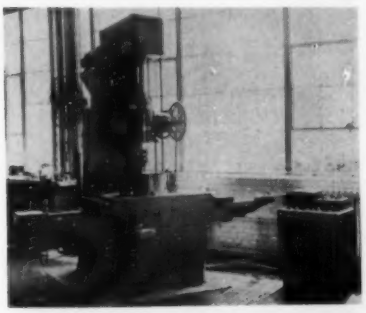
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and timing cams for electrical initiation of tooling sequences. The shaft extension can also actuate auxiliary camshafts for additional tool motions, drive auxiliary feed turrets and time any operation external to the primary work transfer motion.

Swanson-Erie Corp., 816 E. 8th St., Erie, Pa. **Circle 516**

Numerical Control System

Production accuracy of up to ±0.0002 on a 40-inch work table, flexibility achieved through modular design, and economy are advantages of a numerical control system. Rapid change of the modular units is easily accomplished by a plant technician, reducing downtime and facilitating proper maintenance of the unit. Modular components include a tape reader, distributor, digital analog converter, notch phase dis-



criminator, mechanical module, position indicator control and servo-micrometer. A high degree of accuracy is accomplished by separation of the actuating system from the measuring system. The data processing system establishes an analogue signal proportional to machine motion from a fixed reference point. This is established by tape command, decade switch input or punched card. The response mechanism section establishes machine motion proportional to the analogue signal output of the data processing system. This is basically a simple a-c 60 cycle closed servo loop with a linear feedback potentiometer, geared to the motion, which transmits a feedback signal proportional to position of motion from a fixed reference point. The analogue output of the data processing section is compared with the feedback signal in a bridge circuit creating an error signal, which drives the response mechanism to null-balance with every

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TOOLS of today

change of input information. The motor gear drive actuator is a multispeed system. The high speed provides rapid traverse by means of a motor driving through a conventional gear train. The lower speeds direct the machine motion to final positioning, which is obtained by means of a special electro-mechanical micrometer system. It consists of three units: an accurate gage bar with stops located every inch along the length; the servomicrometer assembly.

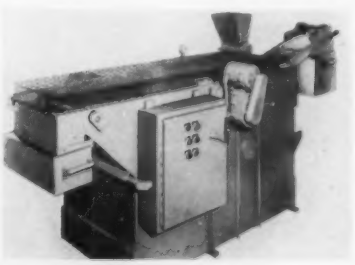
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whose function is to engage a particular stop to achieve a point location; and the position indicating control, which locates final position with extremely accurate repeatability. The numerical control unit can be used in machine and tool shops for automatic control of drill presses, turret punch presses, lathes, milling machines, jig borers and other types of fabricating equipment. It also can be adapted to control operations of spot welding machines, component assembly machines, model positioners and other opto and electro-mechanical devices. Effective use can be realized with almost any machine for which intermittent, terminal positioning of its movable members is essential to, and normally part of its operating cycle, as long as these motions may be driven.

Diehl Mfg. Co., Somerville, N. J. **Circle 517**

Vacuum Coolant Filter

The BarnesdriL vacuum coolant filter, consisting of a dirty coolant tank, drag conveyor, vacuum filter and clean



coolant tank, performs two types of cleaning. Heavy particles settled to the bottom of the dirty coolant tank are removed by the drag conveyor. The vacuum filter unit is then immersed in the dirty coolant tank, the dirty

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coolant pulled through the filter to the inside of the drum, and the clean coolant pumped into the clean coolant tank.

Diatomaceous earth body feed can be added to the full-flow filter system. The system has capacities ranging from 150 to 1000 gpm.

Barnes Drill Co., 879 Chestnut St., Rockford, Ill. **Circle 518**

Dial Feed Unit

The dial feeding unit shown is used with an Acromark Model No. 212 hot stamping machine. Dial plates are removable and sizes from 10 to 20 inches are accommodated. The unit, which is controlled separately from the press, can be removed from the press for hot stamping individual products or items up to 5½ inches high and will reach



to the center of parts up to 14 inches deep. Up to 50 parts per minute can be attained with the 4, 6, 8, 12 or 24-station dial.

The Acromark Co., 607 Morrell St., Elizabeth, N. J. **Circle 519**

Inspection Machine

A new concept of two dimensional inspection, the Ferranti FI-22 coordinate inspection machine, is a compact, solid state unit which can read out hole center locations in two axes simultaneously to an accuracy of 0.001 inch. This single unit inspection laboratory is capable of checking complex workpieces up to ten times faster than conventional inspection equipment. Measurement is accomplished by moving a probe along a fixed axis to which is attached an accurately ruled grating. A moire-fringe pattern is created by the imposition of a movable reference grating over the fixed grating. By reading

Here's the latest inspection equipment





The Profilometer, Proficorder and Microcorder are used on metals, paper, plastics, ceramics and many other materials.

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PROFILOMETER® — Measures the roughness of practically *all* machined and finished surfaces, internal and external, in microinches (arithmetical or r.m.s. average height). Fast; dependable; easy to use.

PROFICORDER® — Draws magnified profile of internal and external surfaces, showing absolute deviation from flatness or roundness. Chart shows *roughness* only, *waviness* only, or *total profile*, as desired; permits measuring height, width and spacing of waves, bows, steps, roughness and other irregularities.

MICROCORDER® — Draws magnified profile of internal and external surfaces along straight path of trace. Chart shows pits, pores, scratches, chatter marks and similar irregularities in detail.

WAVOMETER® — Measures the microinch height of waviness irregularities (r.m.s. average) around internal and external surfaces of rotation on a production basis.

. . . FOR MEASURING RUNOUT

VAROMETER® — Measures runout of spindles, shafts, wheels etc. while the parts are rotating. Also used for surface analysis.

. . . FOR TESTING BALL BEARINGS

ANDEROMETER® — Measures the characteristics of assembled ball bearings that result in noise and vibration, in production and receiving inspection. Enables bearing users to write *numerical specifications* (in Anderons) for overall quality of ball bearings.

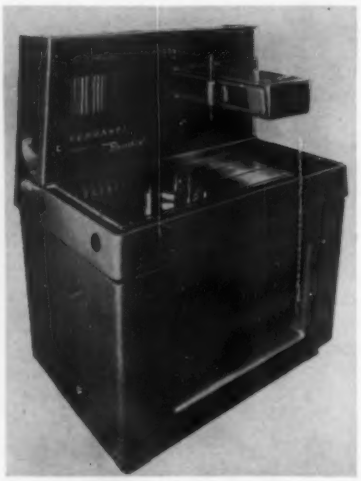


WRITE FOR LITERATURE ON ITEMS OF INTEREST

MICROMETRICAL MMC MANUFACTURING COMPANY
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MANUFACTURER OF THE PROFILOMETER® • PROFICORDER® • MICROCORDER®
WAVOMETER® • ANDEROMETER® • VAROMETER®
Use Reader Service Card, CIRCLE 87

both the dark and light phases of the fringe pattern, the electronic counting units of the FI-22 are able to record 0.001 inch increments on a scale which



is ruled with 500 lines per inch. Probe position is displayed on two sets of position indicators, one for each axis. The system will accurately record probe movement at speeds of up to 30 ips. A flexible machine, the FI-22 has a floating zero which may be established at any point within its 24 x 15-inch working range. Positive motion may be read in either direction through the use of inverting switches for each axis. A selection of interchangeable taper probes and flat center ground probes will permit the inspection of any hole or edge location. By using a scribe in place of the inspection probe, the machine is capable of fine layout work.

Industrial Controls Section, The Bendix Corp., 21820 Wyoming Ave., Detroit 37, Mich. **Circle 520**

Briquetting Press

Built for dry-pressing ceramic materials, powdered metal, carbon and any other powdered material, this crank toggle press has 2⅜ inches of fill depth. The press is equipped with hydraulically controlled floating die table to insure uniform distribution of density throughout the compacts. The machine has ample space for multiple cavity tooling and operates at speeds from 10 to 19 spm.

Haller Inc., 16580 Northville Rd., Northville, Mich. **Circle 521**

Enclosed Motors and Generators

Totally enclosed d-c motors and generators are designed for both constant-speed drives and drives involving fast, wide speed changes and reversals. Fan-



cooled and nonventilated machines in both industrial and explosion-proof construction are available. The motors are rated from ½ to 60 hp at 300 to 3500 rpm and the generators are rated from ¾ to 40 kw at 850 to 3450 rpm.

Westinghouse Electric Corp., Box 2278, Pittsburgh 30, Pa. **Circle 522**

Roll File

This portable roll file weighs 8 lb and accommodates four complete sets of plans, prints, maps or drawings. It consists of four tubes mounted in a steel housing with a spring-latched



door. The housing measures 12½ x 4½ inches and has a fold-away handle. The 23½-inch tubes have a 2⅝-inch diameters. A 30-inch-size file is also available.

Plan Hold Corp., 5204 Chakemco St., South Gate, Calif. **Circle 523**

Direct-Reading Dial Gages

Inside diameters of bores and housings, retaining ring grooves, O-ring grooves and other internal recesses ranging from 0.40 to 3.0 inches can be accurately measured with these di-



rect-reading, caliper type, dial-indicator gages. The instruments are calibrated in graduations of 0.001 or 0.0025 inch, depending upon size, and have a reach of 2⅜ inches. The gages have a shockproof, jeweled movement and unbreakable crystal, and are equipped with replaceable needle type contact points.

Waldes Kohinoor, Inc., Long Island City, N. Y. **Circle 524**

Portable Punch Riveter

All operations—punching the hole, placing the rivet and heading—can be performed automatically by this portable punch riveter. The riveter, weighing 50 lb, is furnished with a cable type balancer for overhead suspension and can be permanently installed on a workbench. It is a ⅛-inch machine of the pneumatic squeeze type with a finger trigger and hand grip.

ACF Industries, Inc., Riverdale, Md. **Circle 525**

Vibration Absorptive Material

Designed to prevent the transmission of machine vibration and noise to surrounding areas, Vibra-Check material eliminates up to 90 percent of vibration. It is composed of two layers of vinyl chloride elastomeric resin, bonded to both sides of a reinforcing core of monofilament fiberglas and then fused under heat and high pressure to form a unit of three layers. Resistant to moisture, oils, greases, detergents, brine, solvents and other chemicals, the material has a breaking point of 7500 psi. Sheets of 22 x 23 inches are available or pads can be cut to sizes suitable for the base or feet of any machine in such a manner as to yield a unit loading of between 50 to 100 psi.

Lowell Industries, Inc., Allston Sta., Boston 34, Mass. **Circle 526**

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Coordinatograph

This Aero-Haag Streit automated coordinatograph accepts tape or card in-



put to plot grid systems or coordinate positions over a 47¼ x 47¼-inch working surface with an accuracy of

V40 BOND WHEELS

ARE AVAILABLE

for all tool room grinding operations

Here's a complete line of tool room wheels that will do a wide range of work on die steels and high speed tool steels. These wheels cut cool and fast. Heavy infeeds can be taken without burning the material. Their superior form-holding ability eliminates costly stops for dressing halfway through a job. Yet, when dressing between jobs, the special vitrified bond composition permits faster, easier dressing with substantial savings in time and abrasive.

V40 bond tool room wheels are available as NATIONAL STANDARDS by Carborundum for simplified ordering and inventory control. Ask your local distributor for recommendations to meet your specific requirements. He carries a stock of many of these popular wheels for immediate delivery.

CARBORUNDUM

BREAK THE 'PROFIT SQUEEZE' with Brightboy!



Use these

NEW SLANTS *to*

- **Save your time**
- **cut your costs**
- **improve your product quality**

In multi-use Brightboy abrasive and rubber function simultaneously to produce a finish that often constitutes the final polish:

BURRING • FINISHING
CLEANING • POLISHING
frequently in one operation.

The revolutionary new concept of abrasive applications for working all metals, wood, glass, laminated materials, some plastics. JOB-MATCHED STOCK TEXTURES, extra fine to extra coarse, in soft, semi-firm, firm and tough rubber binders. *The only complete, comprehensive stock line of soft rubber bonded abrasives.*



Write for this illuminating outline of new & additional applications for abrasives

the new BRIGHTBOY CATALOG

- Methods and applications
- Machine speeds
- Job-matched stock grains & textures
- New, revised wheel sizes

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WELDON ROBERTS RUBBER CO.
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America's Pioneer Manufacturer of Rubber-Bonded Abrasives

WELDON ROBERTS
Brightboy
RUBBER CUSHIONED ABRASIVES

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TOOLS of today

±0.0015 inch. The instrument has a Flexowriter unit, a projection type digital display and an optical line-following device to record X and Y positions of closed curves and irregular shapes. Closed circuit TV can be added for remote control or viewing. The maximum operating speed is 3 ips and the minimum is 0.001 ips.

Aero Service Corp., 210 E. Courtland St., Philadelphia 20, Pa. **Circle 527**

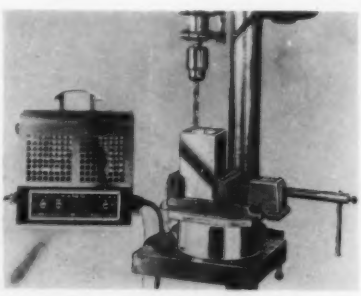
Heavy-Duty Drill

Intended for duct work and sheet-metal applications, this heavy-duty, all ball-bearing drill has a precision keyless chuck that can be tightened or released with a twist of the fingers. This model is one of ten drills designed for use with wood, metal, brick, cement block and plastic. The drills range from ¼ to ⅜ inch in size and have speeds from 750 to 5000 rpm.

Porter-Cable Machine Co., Syracuse, N. Y. **Circle 528**

Electromagnetic Vise

Electromagnetic base with this vise assures positive position when used on drill presses, tapping or milling machines. It eliminates 75 percent of set-up time and will increase production and save labor time. The device completely eliminates hold-down clamps, bolts or drilling of table top. Other electromagnetic holding devices with ball joint vise or air chucks are available.



Redmer Air Devices, Inc., St. Petersburg, Fla. **Circle 529**

Numerical Control Unit

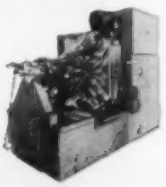
Bendix's DynaPath-20 series numerical control units incorporate completely transistorized construction, automatic interpolation of circular cutter paths, and binary-coded decimal input tape



the special meaning

of BAIRD

You own a machine tool that's 15 years old. You bought it new or, perhaps, used. You need spare parts. You go to the manufacturer and learn that while that same machine model is still being produced, there is no assurance that the parts you used will fit.



CHUCKER
A spindle checking machine for short-run and high production work

This is one of the enigmas in the machine tool business today and the problem has its roots in quality control.

Here at Baird, unless there has been a complete model redesign, individual components on 1960 machines can be used on "sister" machines manufactured 25 and 30 years ago. Interchangeability is simply no problem.



BWI
All new inclinable ribbon and wire forming machine

There's another example of the special meaning of Baird to those of us charged with the responsibility of quality control. As manufacturers of high production equipment... Chuckers, Transfer Presses, Four-Slide equipment... Bench Presses and Vertical Continuous Lathes, our machines are never "finished" on the customer's floor. Before shipment, tooled machines are given good, solid production runs and parts are thoroughly checked to insure perfect operation and output. This is standard operating procedure, whether customer representatives visit us for a demonstration or not.

Do business with Baird... it pays.

Arthur DuBois

Arthur J. DuBois

BAIRD

THE BAIRD MACHINE COMPANY
1700 Stratford Avenue, Stratford, Conn.

Use Reader Service Card, CIRCLE 91

format. This system, which has an electronic resolution of 0.0002 inch, is capable of machining parts to a tolerance of less than 0.0001 inch.

Bendix Corp., 21820 Wyoming, Detroit 37, Mich. **Circle 530**

Rotary Indexing Table

The double-table arrangement of the Milichex Model M2X-900 rotary indexing table allows setting angles to quarter degrees with accuracy of ¼ second of arc. The 360-tooth lower table indexes in full degrees. The upper table is a 96-tooth table with each tooth equal

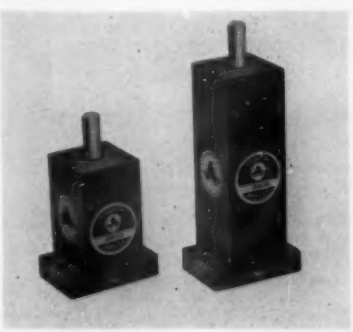


to 3 deg 45 min. The table, which has a top diameter of 12 inches, can reproduce any angle in increments of 15 min.

Michigan Tool Co., 7171 E. McNichols Rd., Detroit, Mich. **Circle 531**

Spring Return Air Clamps

Models ACM-110 and ACM-120 spring return clamps have 1⅛ bore x 1 inch stroke and 1⅛ x 2 inch, re-



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NEW! NEW!

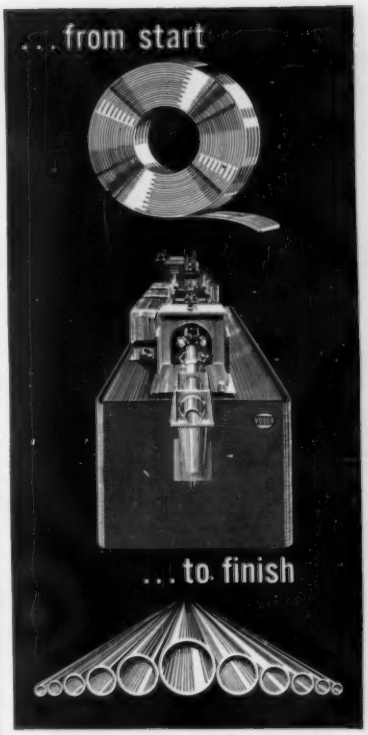
DISPOSABLE CARBIDE SCREW-TIP BORING BAR by

CRAFTS

Now you can cut deep, small bores fast, accurately — *and at less cost.* Precision made, Crafts New Boring Bar #1018 has a solid Carbide Shank — 3 times as rigid as steel — designed for holes ¼" diameter and up. Bore to "tenths" and hold the size. The inexpensive Carbide Tipped Screw-Tip is easily replaced — can be either discarded or resharpened if preferred. Also available — ½" O. D. Sleeve Adapter, for use in Jig Borers. For specifications and prices write to:

ARTHUR A. CRAFTS CO., INC.
603 NEWBURY STREET
BOSTON 15, MASS.

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YODER PIPE & TUBE MILLS

A Yoder engineer can help you realize remarkable savings in the manufacture of ferrous or non-ferrous pipe or tube. He can show you how present Yoder Pipe or Tube Mill owners are increasing production, lowering over-all manufacturing costs and reducing downtime through use of Yoder Mills.

If your products require pipe or tubing from ⅜" to 26" diameters, Yoder Pipe or Tube Mills and accessory equipment can help you produce your product more efficiently to meet today's competitive markets.

In addition to Pipe or Tube Mills, Yoder engineers and builds a complete line of Slitting equipment and Cold Roll-Forming Machinery.

For complete information on Yoder Tube Mills...send for the fully illustrated, 64 page Yoder Tube Mill book ...it is yours for the asking.



THE YODER COMPANY
5525 Walworth Avenue • Cleveland 2, Ohio

ENGINEERING YODER MANUFACTURING
PIPE AND TUBE MILLS
(ferrous or non-ferrous)

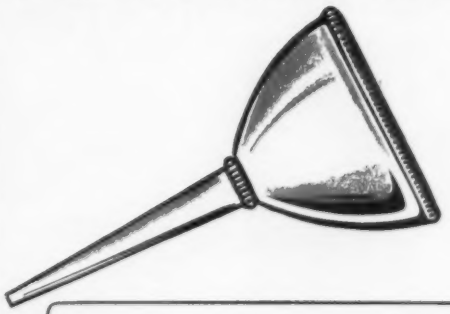
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JARVIS UNVEILS A REVOLUTIONARY DESIGN IN COLD FORMING TAPS!

NEW JAR-FLO

LUBE-GRUV® TAPS

LUBRICATION GROOVES MAKE CHIPLESS FORMING OF INTERNAL THREADS AS EASY AS CONVENTIONAL TAPPING!





NOW, for the first time, cold forming taps that give *full time lubrication* to the *forming contact* area during the *full* tapping cycle.

LUBE-GRUV® gives you a *far superior finish* on the formed threads than is possible with conventional cold forming taps.

USE CONVENTIONAL TAPPING EQUIPMENT. The combination of *positive lubrication* and *narrow contact* surface makes the forming of internal threads much easier than with ordinary cold forming taps. Jar-Flo with LUBE-GRUV has less drag, requires less driving torque.

LUBE-GRUV® Jar-Flo TAPS FOR CHIPLESS FORMING INTERNAL THREADS IN DUCTILE MATERIALS—STRONGER THREADS—NO CHIPS—AVAILABLE IN PLUG OR BOTTOMING TYPES

SEND FOR COMPLETE DETAILS

JARVIS CORPORATION, 100 Washington Park North Attleboro, Mass.

___Have Rep. call ___Rush LUBE-GRUV Brochure

Name _____ Title _____

Company _____

Street _____

City & State _____

Jarvis CORPORATION

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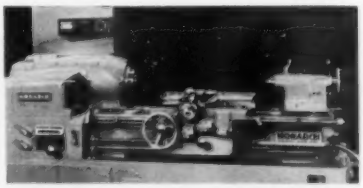
TOOLS of today

spectively. The bodies are of a Samak alloy and the piston rods are of ground and polished stainless steel. Holes are provided both in the body and the base for either horizontal or vertical mounting.

Allenair Corp., 25 E. 2nd St., Mineola, N.Y. **Circle 532**

Variable Speed Lathe

The Series EE, Model 1000, is a versatile, 15-hp lathe equally suitable for manufacturing or for toolroom use. It swings 16 inches over the bed, 8¾ inches over the cross slide and is offered in 30 and 54-inch center distances. Infinitely variable speeds, for-

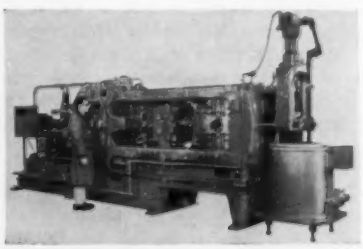


ward or reverse, can be secured between 20 and 2000 rpm. Speed control is all electric while the shift itself is hydraulically actuated. The d-c main drive motor secures its power through an electronic conversion unit.

Monarch Machine Tool Co., Sidney, Ohio. **Circle 533**

Zinc Die Caster

Deep-draw zinc parts weighing up to 15¼ lb and requiring adequate locking tonnage can be produced on the HP-450Z-SF zinc die-casting machine. This model delivers 450 tons of clamping pressure while providing a die



opening stroke that is adjustable from 8 to 30 inches.

The machine has a self-aligning zinc end and a nitrogen accumulator with

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a 5280-cu in. capacity. The injection plunger stroke is nine inches. The movable platen, completely unobstructed, is 38 x 40½ inches with a vertical clearance between the beams of 27 inches. A 25 x 91-inch opening at the top of the frame renders the die space accessible from all sides. The pumping system has a 30-hp motor and a 2000-psi booster pump.

Lester-Phoenix, Inc., 2711 Church Ave., Cleveland 13, Ohio. **Circle 534**

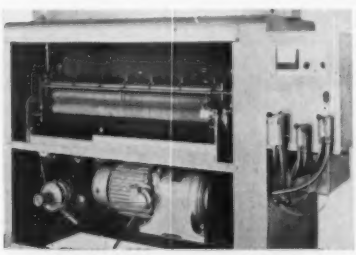
Brake and Clutch

Haydon's fractional horsepower electric brakes and clutches, through the use of improved magnetic materials, offer high torque per unit size. They are available in two sizes: 0.875-inch diam with 2 in-lb and 1.725-inch diam with 10 in-lb torque. They are supplied as 28 volts or 90 volts standard.

Haydon Div., General Time Corp., 245 E. Elm St., Torrington, Conn. **Circle 535**

Sheet Surfacer

Sheet surfacing operations ranging from cleaning and preparing metals for drawing to graining and polishing can be done on the Tri-Matic oscillat-



ing sheet surfacer. This machine employs abrasive-impregnated nylon mounted on an arbor which is adjustable to oscillate from 0 to 400 times per min. The workhead, available in lengths from 48 inches, can be equipped for single or variable speed and the feed rolls are equipped with variable-speed drive.

Sales Service Mfg. Co., St. Paul, Minn. **Circle 536**

Antifriction Screw

Designed as a replacement in a surface grinder or for original equipment use, this antifriction screw will hold any elevated load without slipping. Counter rotation of the screw is prevented by a nonrecirculating ball screw assembly. It offers pitch accuracy of 0.0001 to one inch of travel and has

penny wise and pound foolish?



An old saying but never truer.
Buying taps on a price cutting wave can actually increase your cost.
The only intelligent way to buy taps is on the basis of their performance.
The important question is: how many tapped holes per dollar of cost?

Crōmclad® TAPS

have proven to hundreds of plants large and small the superiority of *chrome treated* taps for long life and trouble-free performance.

We are the largest exclusive maker of chrome-treated taps. Write for price list.

NEW ENGLAND TAP COMPANY, INC. 1 Endicott St., Norwood, Mass.
Send price list on Crōmclad Taps to
Person_____
Company_____
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only four threads per inch. This screw may also be used for applications such as a spring spreader where compression is desired. Dimensions are ¾-inch diam and 19-inch length.

R.C.S. Tool Co., 13861 Van Owen St., Van Nuys, Calif. **Circle 537**

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Numerical Positioning System

A machine control unit, DynaPoint-20, is a high-performance control, operating on a closed loop servo system and capable of an electronic resolution of 0.000010 inch. With this resolution, the unit can position a jig borer table to tolerances of less than 0.0001 inch within the range of table travel. Motion is simultaneous in both axes. The DynaPoint-20 is a compact, solid state unit, occupying only six sq ft of floor space. Its mechanical tape reader uses standard 8-channel binary-coded decimal paper or plastic tape. Ten auxiliary functions may be programmed in addition to dimensional data, using standard flexowriter codes. Flexibility of operation is provided by separate dial input switches that will allow manual positioning of the workpiece to the

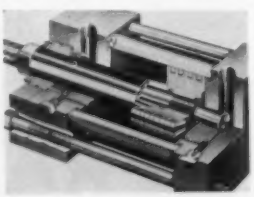


nearest ten-thousandth of an inch. Set-up is simplified by the zero offset feature. This permits the initial reference point to be located on the work rather than on the table.

The Bendix Corp., Industrial Controls Section, 21820 Wyoming Ave., Detroit 37, Mich. **Circle 538**

Hydraulic Cylinders

Sheffer's C4H Series hydraulic cylinders feature tie rod construction, long-wearing rod cartridges and four different types of piston packing. These interchangeable 2000 to 3000-psi cylinders have 1⅛ to 12-inch bores with 17



mountings. Tapered cushions eliminate cushion-adjusting screws, provide gradual deceleration and eliminate shock upon entrance of cushion piston.

Sheffer Corp., 326 W. Wyoming Ave., Cincinnati 15, Ohio. **Circle 539**

Ultrasonic Sensing System

Consisting of two sensors and a transistorized central unit, the Sonac system uses beams of ultrasonic waves to count, control and monitor. It is

Grind All Types of Profiles To Extreme Accuracy with Studer PSM's

PANTOGRAPH RATIOS

PSM 250 1:1 — 10:1

PSM 130 1:1—100:1

APPLICATIONS

(*With Automatic Grinding Wheel Feed*)

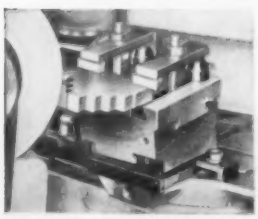
- Grinding of flat form tools
- Grinding of circular form tools
- Grinding of sectional dies
- Taper relief grinding
- Grinding of crushers or rolls between centers
- Grinding to complete 360° contours



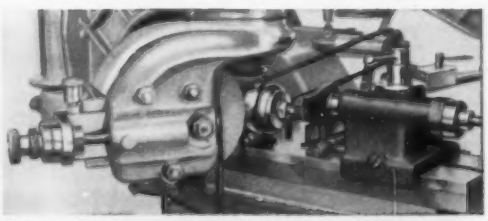
Punches and inserts of guide plate and cutting plate, with respective clamps — ground on a Studer.

ADDITIONAL SPECIFICATIONS

	PSM 250	PSM 150
Maximum template length	24"	16"
Profile length in one setting	16"	6"
Diameter of crushers or rolls	10"	4"



Profile grinding of a flat form tool.



A Studer set up for cylindrical grinding. Workpiece held between centers.

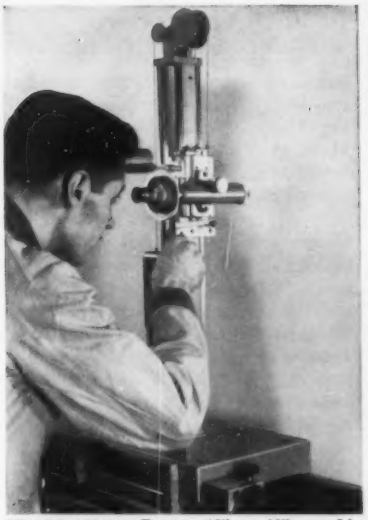
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M1238-1818 — *Range 18" x 18", working distance 9" to infinity. Reads to 0.001" up to 24" working distance. Protractor ocular reads to 3 minutes of arc. Image is erect.*

Cut inspection time in half

with new Gaertner Coordinate Cathetometers

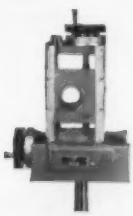
These convenient, reliable optical instruments permit making precise coordinate measurements in a vertical plane. The two dimensions are measured with one setting, object does not have to be rotated. Inspection time is cut in half and resetting errors eliminated.

Versatile Gaertner Coordinate Cathetometers are ideally suited for precision measurements on large objects; also objects or points in recessed, remote, or inaccessible locations. Applications include measuring jet engine sections, complicated castings, printed circuits, bolt holes and bosses on large piece parts, traces on cathode ray tubes, etc.

Because these are optical rather than mechanical measuring instruments, you make non-destructive measurements without contact, distortion, or concern about pressure being applied to the object when making a setting. Instruments available in English or Metric system.

M1236-46— Horizontal range 6", vertical range 4". Reads to 0.0001", working distance 5" to infinity.





M1236-22— Range 2" x 2", reads to 0.0001". Working distance 5" to infinity. Shown with 19 mm mounting rod, and without telemicroscope. Instrument permits precise coordinate movement of other objects such as photo cells, probes, etc., in place of telemicroscope.

The Gaertner Scientific Corporation

1241 Wrightwood Ave., Chicago 14, Ill.
Telephone: BUckingham 1-5335

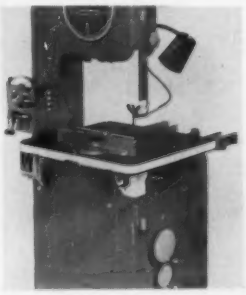
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suitable for automatic counting, weighing, positioning and similar production-line operations. In principle, the system operates similarly to photoelectric sensing systems. When the ultrasonic beam is interrupted, a control switch is actuated. The beam is not affected by vibration, dust and smoke.

Aro Equipment Corp., Bryan, Ohio. **Circle 540**

Band Machine

Model 1612-UGT glide table utility band machine has a 16-inch throat and a 12-inch work height. The 24 x 24-inch worktable, mounted on eight rollers, has 12 inches of manual travel or eight inches of travel with power feed attachment. Band speeds from 50 to 5200 fpm in two ranges permit the use of a 1-hp motor and saw bands from 1/16 to 1/2 inch wide. The table may be locked for contour cutting and a work-stop and mitering attachment are furnished. Other features are dual range transmissions, air pumps and chip blowers, band tension and speed indicators and removable chip drawers. Light maintenance and toolroom work in steel as well as nonferrous metals, plastics, paper products and wood can be performed by this machine.



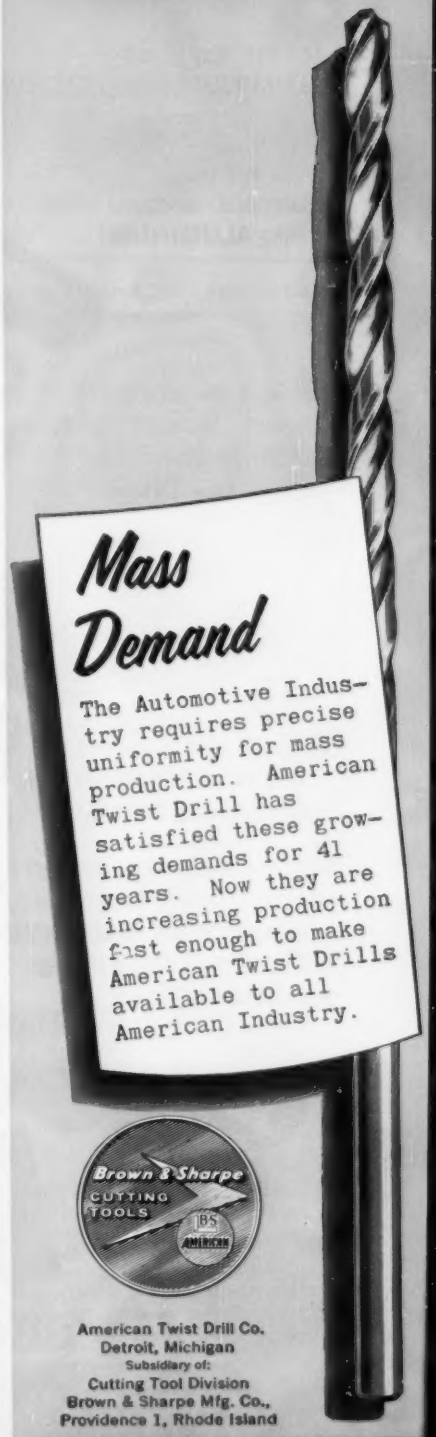
DoAll Co. **Circle 541**

Epoxy Resin Adhesives

Three high-strength two-component modified epoxy resin adhesives that cure at room temperature under contact pressure are EC-1751, EC-1838 and EC-2054. They are used for high strength metal and plastic structural bonding applications where heat and/or pressure are not feasible in the bonding operation. All three adhesives maintain high-strength properties over a service temperature range of —67 to 160 F. Shear strengths of metal to metal assemblies bonded with these adhesives range from 2300 to 3200 psi at 75 F service temperature. They have high creep resistance under constant

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Detroit, Michigan
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MILLING ALUMINUM

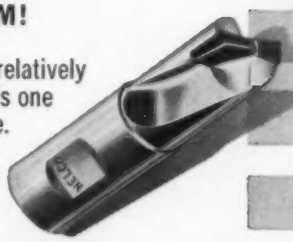
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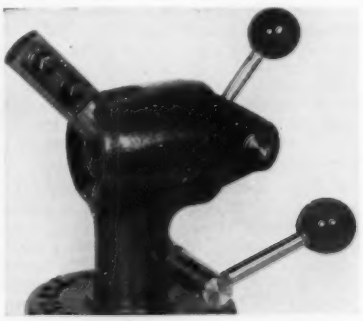
TOOLS of today

stress, exceptional adhesion to metals and plastics and good resistance to water, hydraulic oil and aromatic fuels. Their self filleting properties makes them useful for honeycomb sandwich construction. The paste type consistency of the adhesives provides void filling properties which permit the structural bonding of loosely fitting parts. This property also permits them to be used as a synthetic solder or void fillers for repairing and filling holes, dents and cracks in metal parts, castings and sheet metal. Being 100 percent nonvolatile, these adhesives are particularly useful for bonding impervious surfaces.

Adhesives, Castings and Sealers Div., Minnesota Mining and Mfg. Co., 900 Bush Ave., St. Paul 6, Minn. **Circle 542**

Holding Device

Work loads up to 70 lb can be rigidly held at any angle by this multipurpose holding and assembly-speeding device. Named the Roto-Arm, this device has an arm for attachment of work loads, which can be moved up and down from 110 deg to a vertical position. On a horizontal plane, work can be rotated to any position or moved



radially 20 deg from center in any direction. The swivel at the base can be rotated 360 deg without changing the vertical angle position. The device can be used on assembly lines, inspection lines, conveyor or permanent bench mountings.

Charles Parker Co., Meriden, Conn. **Circle 543**

Electronic Die Protector

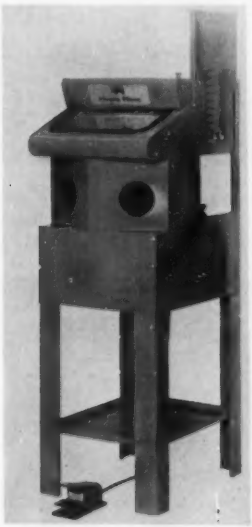
Punch press die damage can be prevented by the Bulletin 5107 die protector. It allows the press to recycle only if a part is ejected from the previous cycle. The protector can be

used with automatic or manually fed presses having electric clutches and will detect parts of any shape and material. Models designed for using three different methods of detecting ejected parts — photoelectric, impact and RF coil—are available.

Clark Controller Co., 1145 E. 152nd St., Cleveland 10, Ohio. **Circle 544**

Liquid Blast Machine

Model 12 liquid blast cleaning machine has a maximum air consumption of 20 cfm at 100 psi and a 40-gpm pump with a 1/3-hp, 110-volt, single-



phase motor. The air supply and window-washing mechanism are regulated by electrically controlled solenoid valves. The interior of the machine is 13½ x 20 inches and the door opening is 13½ x 10½ inches.

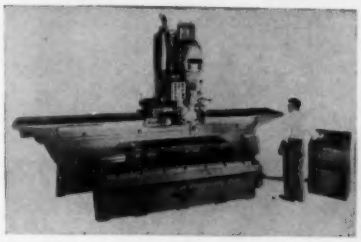
Hydro-Hone Corp., 11055 S. Palmer Ave., South Gate, Calif. **Circle 545**

Programmed Numerical Control

A two-axis, point-to-point programmed numerical control system, applied to a special large drilling machine with a six-face turret head, has a 90-inch-long fixed table over which is mounted a Brown & Sharpe Model B six-face turret drilling head which has 90 inches of programmed movement in the longitudinal axis, and 20 inches of programmed movement in the transverse axis. The spindle feed, or Z axis, of this machine is not programmed, but turret selection is. Numerical input data to the control system can be in

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the form of either one-inch-wide, eight-track punched tape or manual rotary switches. Decimal readout of the input data is provided by numerical indicator tubes. Numerical indicator tube readout of the turret face selected is provided, with a dial switch to allow manual selection of the turret face. Full-range zero offset control is provided for both table and saddle motions, thus allowing the zero datum lines to be set to any position desired. The position-measuring system for both the head and saddle motions is by three-



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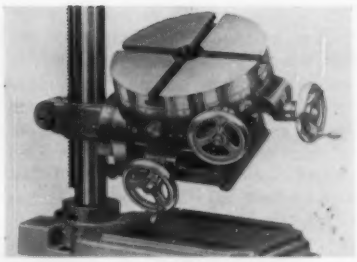
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speed synchro data packages mounted and geared to the machine lead screws. Resolution (the smallest increment of length that can be programmed) and accuracy, respectively, of both programmed motions is 0.001 inch and ±0.001 inch. The head and saddle are simultaneously driven to the programmed positions by d-c motors under control of the numerical control. The d-c motors are backed up by a reversing electronic drive. Maximum positioning speed is 150 ipm.

Reliance Electric and Engineering Co., 24701 Euclid Ave., Cleveland 17, Ohio. **Circle 546**

Drill Press Table

Operations such as drilling, milling, grinding and indexing can be performed on this all-purpose drill press table. The No. 500 table, installed on the press column, provides two cross-slide movements together with 360-deg rotary feed and graduated tilting adjustment. Take-up adjustment is provided for wear in worm and gear and both dovetail cross slides are furnished with adjustable gibs to compensate for wear and to assure ease of travel to suit operation and material.



Chicago Tool and Engineering Co., 8383 S. Chicago Ave., Chicago 17, Ill. **Circle 547**

Automatic Marking Machine

This automatic marking machine marks small parts electrochemically. It is primarily used on thin pieces such as feeler gages and hard pieces such as carbide tips.



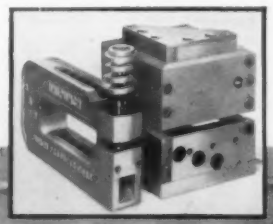
Electromark Corp., Cleveland, Ohio. **Circle 548**

Sensitive Drilling Machine

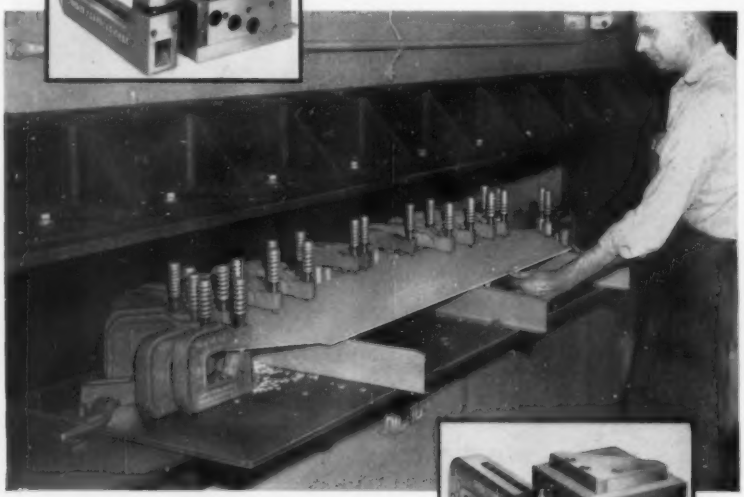
Model 200 sensitive drilling machine has a built-in speed control that allows infinitely variable speeds from 2000 to 11,000 rpm. Designed to take all standard jewelers chucks, collets and attachments, the spindle has a maximum runout of 0.0002 inch. Vertical travel of the 4-inch-diam table is 1¼ inches. Over-all height is 17 inches and base size is 5½ x 6 inches. Drill capacities are 0.004 to 5/32 inch.

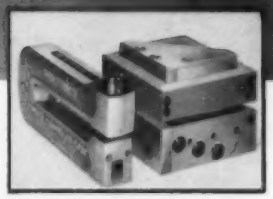
Lloyd Tool Corp., P. O. Box 4007, Pasadena, Calif. **Circle 549**

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UNIPUNCH SERIES "A" Hole Punching Units punch round and shaped holes up to 3" in diameter in up to ¼" mild steel (Series "AH" for up to ½" thick). Notching Units for corner, edge, vee and special shaped notches may be used in combination setups with hole punching units. Both types of Series "A" Units have popular standard 8⅛" shut height and 3½" die height.





UNIPUNCH SERIES "B" Hole Punching Units punch round and shaped holes up to 5½" in diameter in up to ⅛" thick mild steel or equivalent. Standard or special Series "B" Notching Units may be used in combination setups. Both types of Series "B" Units have popular standard 5½" shut height and 2 29/32" die height.

How UNIPUNCH Hole Punching and Notching UNITS save time and cut costs

Unipunch Tooling System produces custom setups with standard units. Simply set up the units outside the press according to the desired hole punching and notching pattern; slide onto press bed; and start producing parts with first stroke of ram — *nothing attached to press ram.*

Unipunch self-contained Units permanently align punches and dies — *no adjustment or aligning.* These Units may be used and re-used in innumerable setups — *no "dead" unproductive storage.* Various mounting methods permit Unipunch Units to be used in presses or press brakes — *no special capital equipment required for production of parts.*

For complete information on punching and notching sheet metal, plates, angles, channels, extrusions

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Punched Tape Code Converter

While preparing original data on a Friden flexowriter, this operator is simultaneously punching a by-product 8-channel tape. The tape can be converted to a 5, 6 or 7-channel code system by the Friden code converter on the right. This machine offers high-speed conversion of any 5, 6, 7 or 8-channel code system, one to the other, as required. It reads 1180 codes per minute and accepts tape $^{11}/_{16}$, $^{7}/_{8}$ or 1 inch wide. The converter has a parity

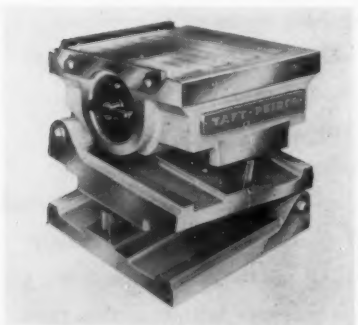


check as well as a built-in code check to insure output code is punched for every input code read. Tapes for computer input and machine-tool control are among the common uses of the converter.

Friden, Inc., 421 University Ave., Rochester, N. Y. **Circle 550**

Sine Angle Magnetic Chucks

Two new sine angle models have been added to a line of permanent magnet chucks. They provide a time-saving, trouble-free means for setting light machining or inspection jobs to either simple or compound angles. On these



models, a control knob on either side will quickly energize the magnetic surface lightly for easy positioning of the work or for maximum grip. Lock screws, which are turned toward the operator, lock the plates at any angle.

(Continued on page 190)



We have all heard the saying ". . . *the impossible takes a little longer.*" B. Jahn has just run 200,000 of these Beryllium Copper Terminals, to Production Prove a seemingly impossible progressive die job at 100 pieces per minute. This is doing the impossible *"right now!"*

One of the requirements that called on all the B. Jahn ingenuity is the two tubular sections of this complex terminal that are opposed to the stroke of the press.

These were produced by rolling stock around 2 arbors and then withdrawing them from the side.

PIECE	Electronic Terminal
STOCK	Beryllium Copper
STOCK DIMENSION	1½" wide .015" thick
PROGRESSIVE DIE	10 working stations
PRODUCTION	100 pieces per minute

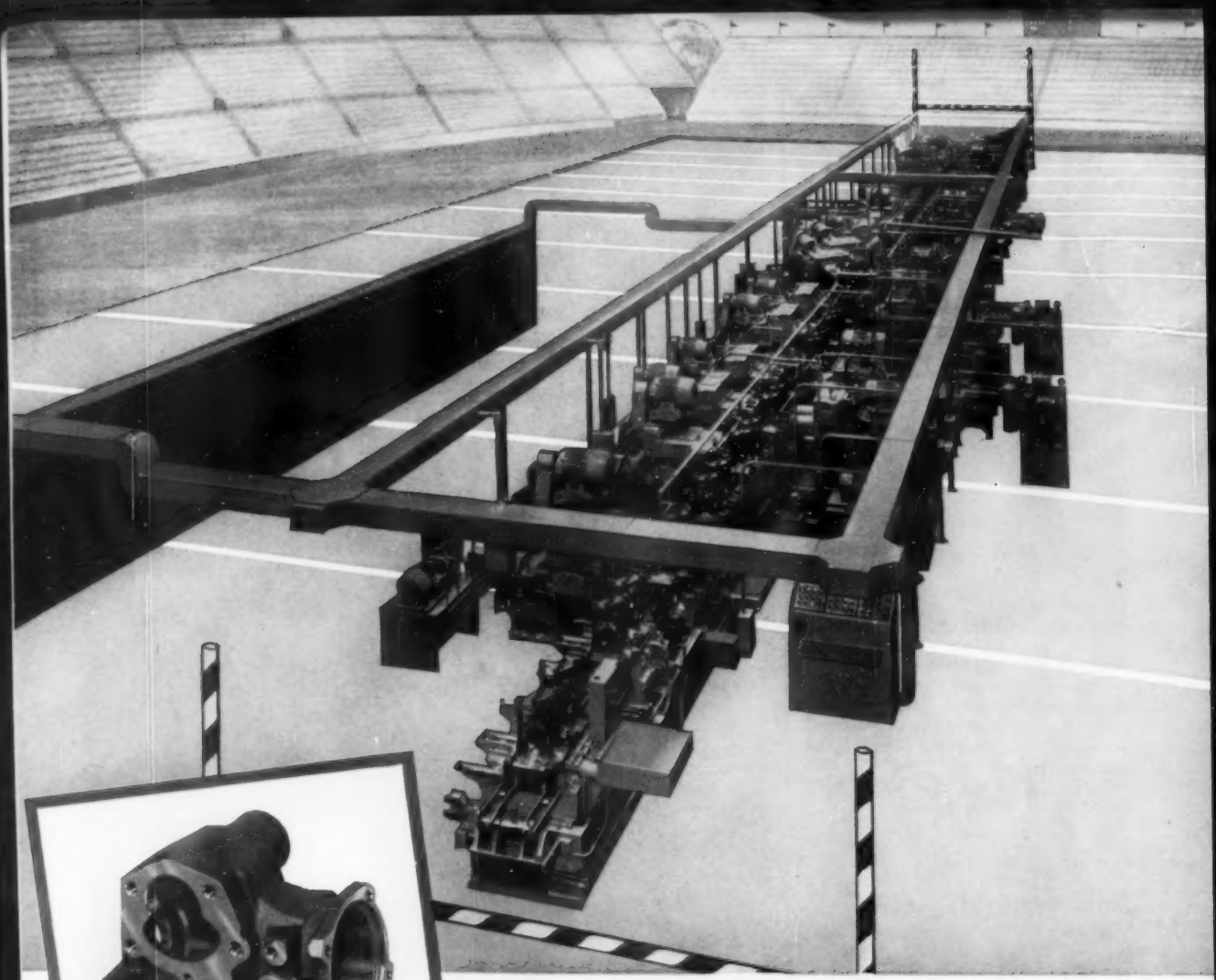
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Ed: This looks good to me - let's discuss it - JB.

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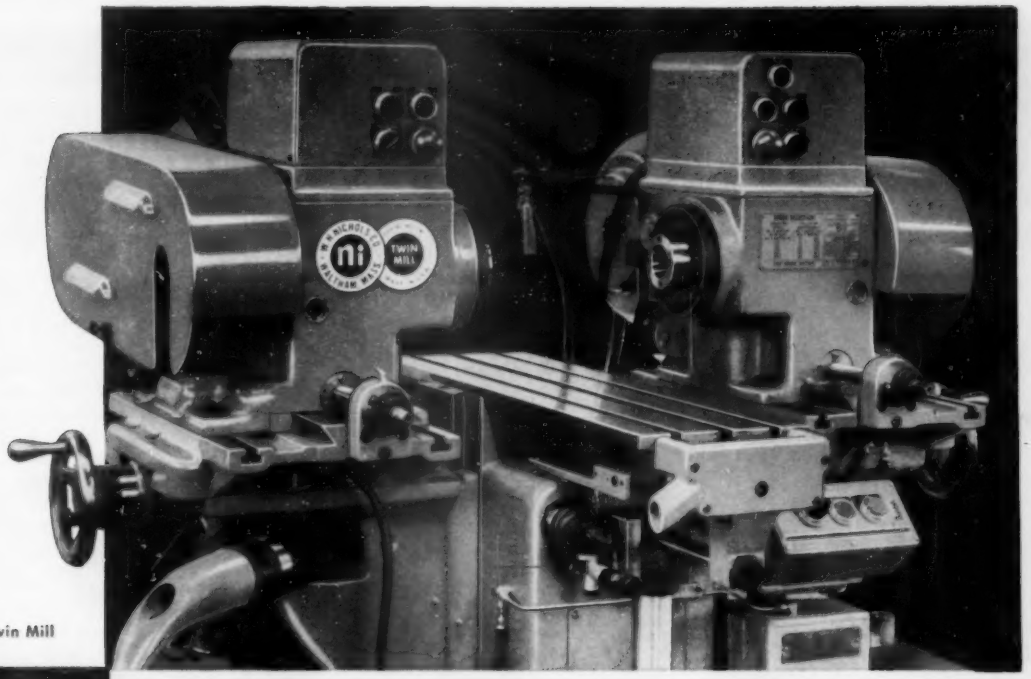
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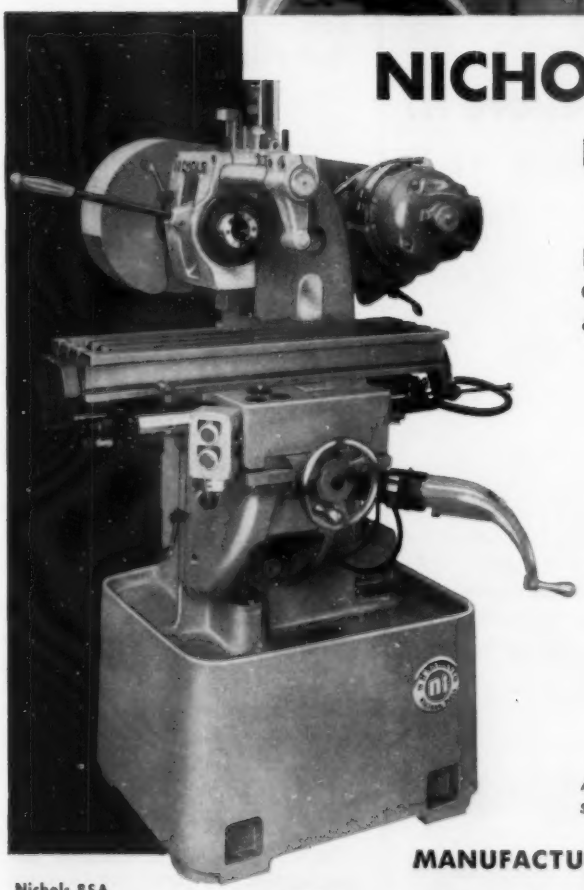
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Twin Mill



Nichols 85A
Semi-automatic

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NICHOLS MILLERS are versatile, work-devouring machine tools, unexcelled in accuracy and fine workmanship.

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For high production precision milling where the double-barrelled approach of the TWIN MILL is not required, there are single spindle NICHOLS Semi-automatic Millers of varying work ranges. In addition to automatic table cycles, synchronized automatic down-feed of spindle head and automatic cross feeds are available.

NICHOLS MILLERS have a magnetic attraction for the Tool Engineer's ingenuity.

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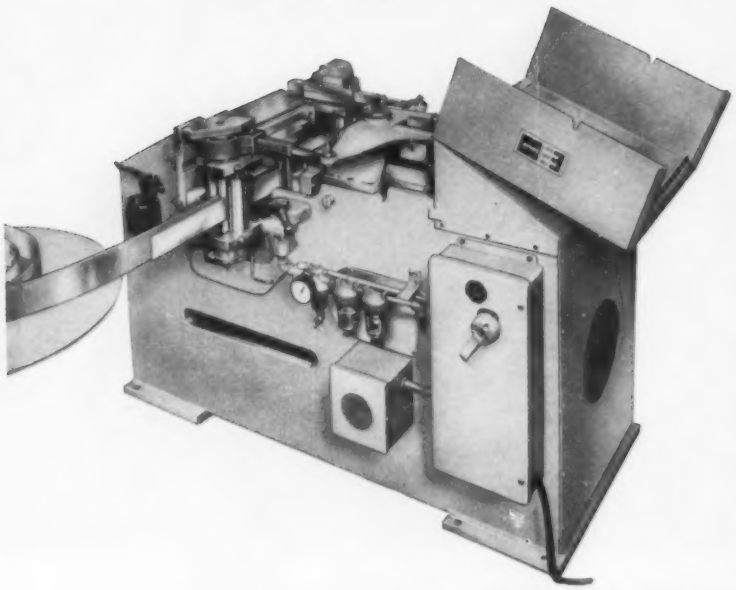
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HUDSON DIVISION, HUDSON, N. Y.

EMHART

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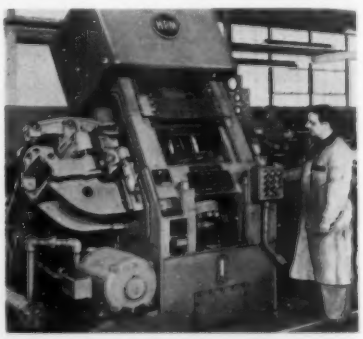
TOOLS of today

Angle settings are obtained by use of gage blocks and a precision-ground step on the base plate makes it possible to set angles down to zero. Back and end stops, both readily adjustable, are provided on both models. Both chucks feature a powerful rotary pack which is permanently magnetized and requires no wiring. Tool steel sine rolls are hardened and lapped and positioned on five-inch centers within ±0.00015 inch. Round and straight within a tolerance of 0.00005 inch, they parallel with each other and the work surface within 0.00010 inch. The precision-ground work surface is flat, square with the sides and parallel to the base within 0.0002 inch. Model 8866-1 is specified for simple angles and model 8866-2 for compound angles.

Taft-Peirce Mfg. Co., Woonsocket, R. I. **Circle 551**

Triple Action Hydraulic Press

Most types of metal up to ¼ inch thick can be blanked to surface accuracies within 0.0005 inch in this triple-action hydraulic press. The blank punch works against a bottom punch and die cushion, while a third

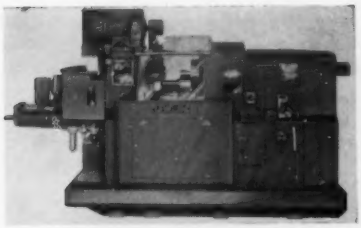


action clamps the material firmly during the blanking stroke. The press, available with automatic feeding and scrap removal, cycles in excess of 100 spm.

Hydraulic Press Mfg. Co., Mount Gilead, Ohio. **Circle 552**

Single-Spindle Automatic

Incorporating an air-operated disk type friction feed clutch, the Cleveland 2½-inch Model AW single-spindle automatic has variable forward and return turret feeds. The machine has 40 spindle speeds ranging from 69 to 1920 rpm and four automatic changes.

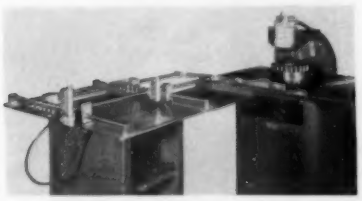


A 5-hole, 11⅝-inch-diam tool turret, having a 9-inch tool circle, using Geneva indexing mechanism, is provided.

Cleveland Automatic Machine Co., Cincinnati 12, Ohio. **Circle 553**

Duplicating Turret Punch Press

This machine, a combination of a turret punch press with a duplicating table, is well-suited to short and medium production runs and light metal fabrication. The table handles templates up to 24½ x 18½ inches. Holes on the workpiece are located by in-



serting a stylus in holes drilled in the template clamped to the duplicator table. Stylus and actuator buttons are incorporated in gripper handles. The semiautomatic machine has 18 punch and die combinations.

Rotex Punch Co., 2350 Alvarado St., San Leandro, Calif. **Circle 554**

Adjustable-Speed Drive

General Electric's static adjustable-speed drive, Statrol, has instant starting ability and is capable of operating under extreme environmental conditions. The heart of the drive is its control module which combines a silicon-controlled rectifier and encapsulated

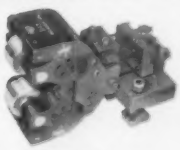
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circuitry. This control module, along with a potentiometer and disconnecting means, constitutes a complete control for starting, stopping and adjusting the speed of a d-c motor. It is available in ratings for ½₀ to ¾ hp and



Reed Thread Rolling Attachments

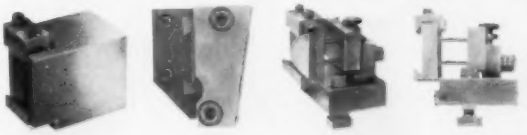
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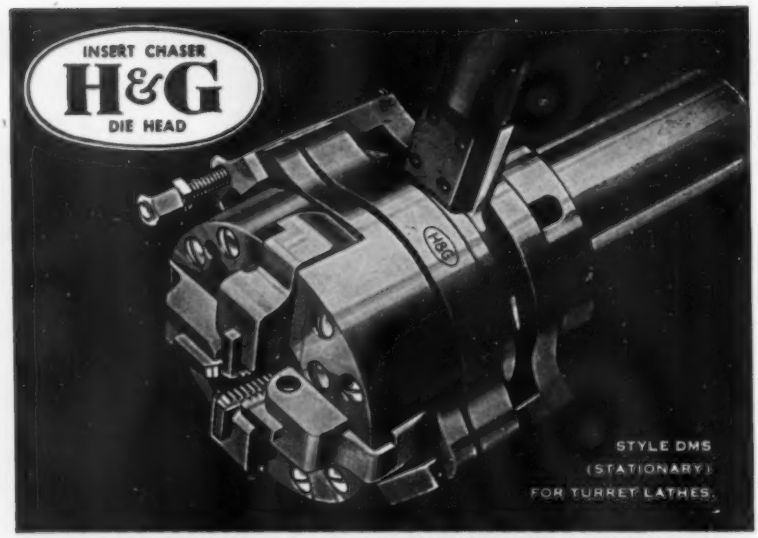
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STYLE AND SIZES FOR ALL MACHINES ON WHICH THREADS ARE CUT

This die head is unique

THERE IS NO OTHER LIKE IT

It cuts threads with insert chasers. These are, in reality, small sections of the business end of large and expensive chasers, but with this important difference: *their cost is so low they can be even thrown away when dull.* For example, for approximately $50 you can get a dozen sets of insert chasers, each set ground ready to go. Change now to insert chaser die heads and watch your performance improve. "UNIFIED AND AMERICAN SCREW THREAD DIGEST" sent free on request.

THE EASTERN MACHINE SCREW CORPORATION 27-47 Barclay St., New Haven, Conn.

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MAKE ALL BRINELL HARDNESS TESTS WITH **The KING PORTABLE TESTER**

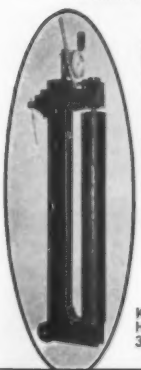


King Test Head with Chain Adapter

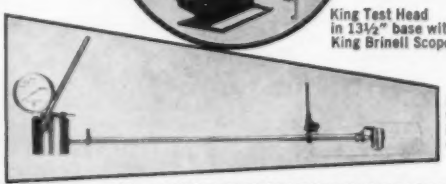


King Test Head in 13½" base with King Brinell Scope

ONE TEST HEAD FITS MANY INEXPENSIVE ADAPTERS



King Test Head in 30" base



King Bore Brinell with small test head for pipes, cylinders, etc.

The KING PORTABLE HARDNESS TESTER

- To test any size, shape or thickness of metal.
- Makes guaranteed accurate on-the-spot tests — anywhere!
- Gap 10" — 13½" — 30". Throat 4" — 6¾" or larger with chain adapter.
- Loads from 62½ Kg. to full 3000 Kg. 5mm or 10mm steel or carbide ball.
- Will make tests in places no other tester can reach—including cylinder bores.

Write for literature and prices to Dept. TE-11-60

KING TESTER CORPORATION 440 N. 13th St., Philo. 23, Pa.
Known the world over for accuracy and dependability

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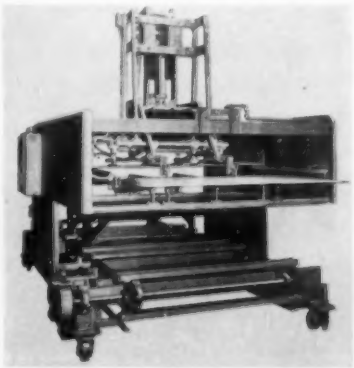
TOOLS of today

has a standard speed range of 8:1. It can be operated from any standard voltage.

General Electric, Schenectady 5, N. Y. **Circle 555**

Destacker & Sheet Feeder

Blank sheets are lifted, indexed forward, deposited on the feed station and pushed into another machine with this automatic vacuum cup destacker and sheet feeder. It incorporates a stock index conveyor which will hold two or

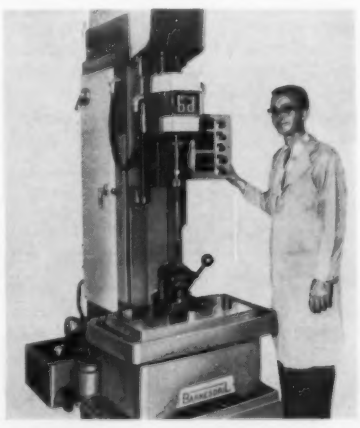


more stacks of blank sheets. When dunnage or pallets are used, the stock index conveyor is equipped with an empty pallet removal station.

Die & Automation, Inc. 5353 Dixie Highway, Hamilton, Ohio. **Circle 556**

Honing Machine

This honing machine is equipped with a 12-inch stroke and a 12-inch swing and will hone bores up to two inches in diameter at maximum stroke. A sizing mechanism maintains size consistency within 0.0002 inch from



bore to bore. Definitely variable speeds from 270 to 870 rpm are indicated on the plate on the right side of the column.

Barnes Drill Co., Rockford, Ill. **Circle 557**

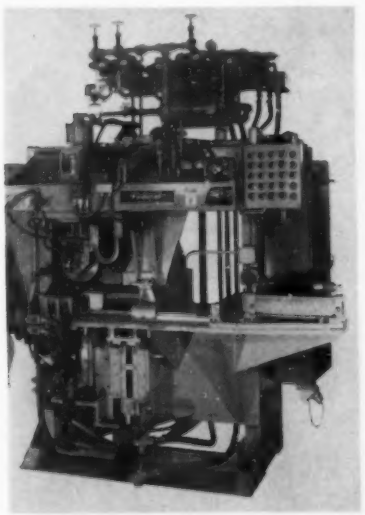
Nylon Drill Sleeve

Up to 25 percent of the vibration that may otherwise be transmitted to the cutting edge of the tool is absorbed by this nylon "Drill-Dapter." A red nylon model protects new drills, preventing scoring of drill shanks. A white nylon model is used to hold drills with broken or scarred shanks, giving new life to tools that would otherwise be unserviceable. White nylon models have a center hole in the tang to make centering and regrinding of damaged drills easy.

American Twist Drill Co., Detroit, Mich. **Circle 558**

Travel Head Seam Welder

A special travel head seam welder with forming clamps transfers the blank from the load position into the



forming unit, where it is formed into a shell and the side seam is welded. After the weld is consummated the forming clamps release and the transfer mechanism ejects the welded part from the machine. The seam is approximately five inches long. Weld pressure is approximately 1200 lb at 60 psi. Weld speeds are adjustable from 200 to 400 ipm. A 200 KVA welding transformer supplies welding power. Production is over 500 parts per hour.

The Federal Machine and Welder Co., Warren, Ohio. **Circle 559**

Automated Tapping Unit

A tapping unit utilizes the lead screw principle providing economy of time and cost by enabling pitch change with the one lead screw and producing highly accurate threads. Use of a coarse pitch ground thread lead screw and nut reduces the effect of wear and provides long life. Tapping pitch is changed by changing only one gear at the back of the unit. This is accomplished in less than 10 minutes and is made at a cost of from one-third to one-tenth the cost of changing the lead screw and nut of other lead screw tappers. The unit is completely self-contained and may be mounted in any position from vertical to horizontal. An oil pump provides circulating oil lubrication to all bearings and gears. All rotating parts are mounted on ball bearings and the guide rods operate in ball bushings instead of sleeve type bearings. Safety controls prevent overtravel in either direction and prevent

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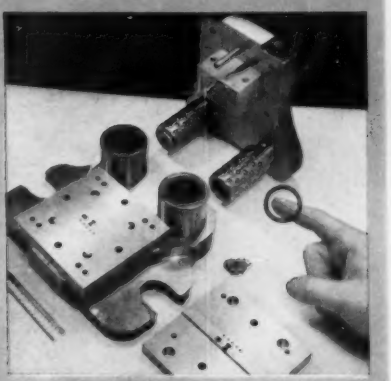
NOBODY SAID "*It Couldn't Be Done*"

BUT ONLY LEMPCO 2 POST STOCK* DIE SETS COULD DO IT!

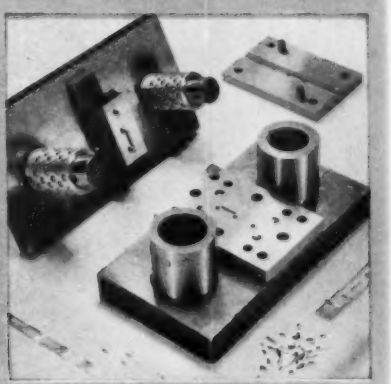
To the best of our knowledge, Lempco is the only 2-post STOCK* die set which could produce this electronics part from .001" thick high nickel alloy material—with punched holes of .001" diameter. This die, mounted in a standard Lempco STOCK* die set, produced 30,000 burr-free parts on its initial run.

Users everywhere have found that a STOCK* Lempco 2-post die set will out-produce special 4-post "friction type" sets—at a fraction of the cost. You can prove this to yourself!

*Off-the-shelf DELIVERY, with warehouse stocks in all major metalworking areas of the U.S.A.



MATERIAL: .001" Thick, High Nickel Alloy
Punched Holes, .001" Diameter





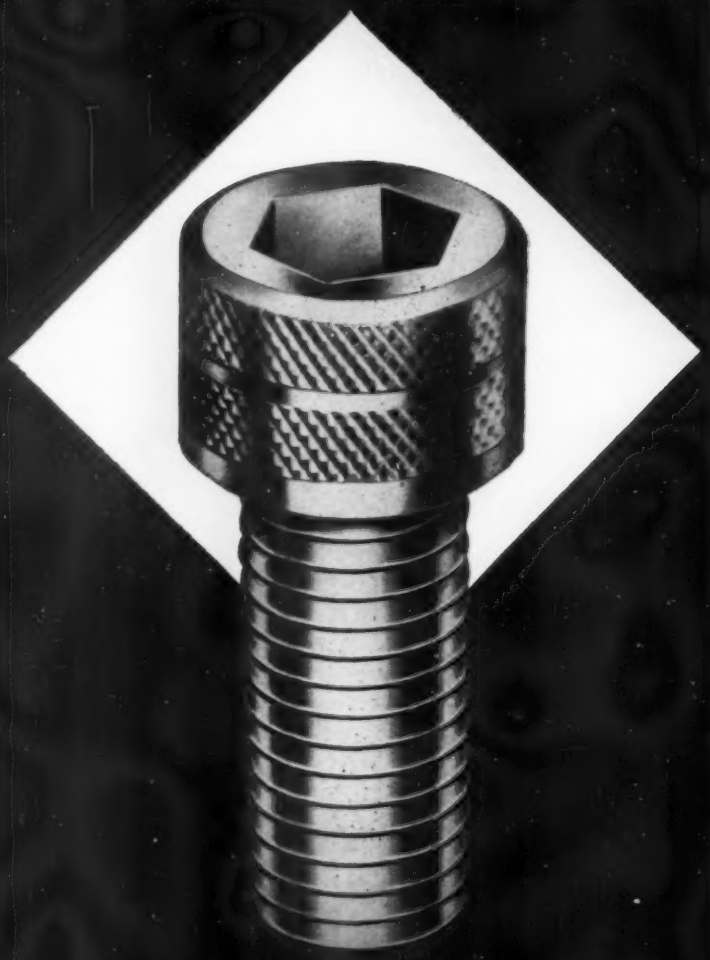
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Diebuilder: Vamco Machine & Tool, Pittsburgh

LEMPCO INDUSTRIAL, INC.
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Are you designing to series 60 standards? If so, specify Bristol.



This DOUBLE-DIAMOND knurl marks the BRISTOL "Series '60"

. . . the cap screw that holds more . . . indents-less . . . wrenches tighter than ever before . . . meets or exceeds all new "Series 1960" standards of Socket Screw Manufacturers' Committee. Of course, regular Bristol "Series 1936" standard screws are still available in hex or Bristol Multiple-Spline.

Precision socket screw manufacturers since 1913



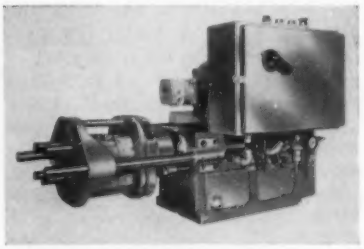
*Made in sizes as small as No. 0 in Alloy Steel and Stainless Steel. Cap screws up to 1½" diameter.

THE BRISTOL COMPANY Socket Screw Division Waterbury 20, Conn.

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TOOLS of today

damage if the spindle hits an obstruction. Completely automatic cycle, manual or jogging operation may be obtained with standard controls. Maximum stroke is 5 inches with 3-inch rapid approach and 2-inch lead screw



travel. All movements are adjustable and may be correlated for automatic operation. The tapping unit illustrated has a 4-spindle double eccentric adjustable tapping head attached.

Thriftmaster Products Corp., 1048 N. Plum St., Lancaster, Pa. **Circle 560**

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Machine Clamp

Specifically designed for all general purpose milling operations, model No. ST3T clamp can be set up in seconds on any T-slot base machine or fixture. The clamp adjusts from 0 to 2-inch heights without extra parts. The operator hand-tightens to pressures that will not disengage under strain. The design combines screw adjustment at the handle end with the speed of toggle action

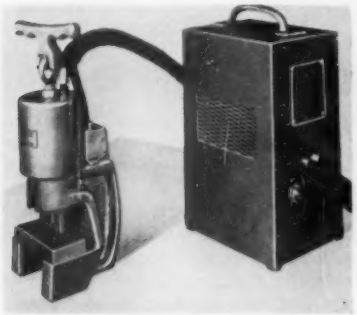


to produce a compact unit that eliminates spacer blocks and wrenches and enables clamping of dissimilar parts with no time lost in setup. A sister clamp, model No. ST2T, provides the same time-saving advantages to light-duty milling and drilling on T-slot base machines.

Tiger-Tool Co., 2103 Moore St., San Diego 1, Calif. **Circle 561**

Notching Press

Three models of the Hydramic notching presses are available with capacities of 10, 20 and 30 tons to handle



maximum notching dimensions from 2 x 1 inch to 2½ x 2 inches in metal thicknesses up to ⅜ inch. A ½-hp hydraulic power unit, which weighs 20 lb, is standard.

W. A. Whitney Mfg. Co., 636 Race St., Rockford, Ill. **Circle 562**

Finishing Machine

This air-cushioned vibratory finishing machine can be used for finishing nearly all ferrous and nonferrous metals as well as plastics and ceramics. Four rubber air cushions provide sus-



pension for the vibratory container and another set absorbs floor vibration. No springs are used. The machine is manufactured in five sizes, ranging from 1½ to 18 cu ft.

Pangborn Corp., Hagerstown, Md. **Circle 563**

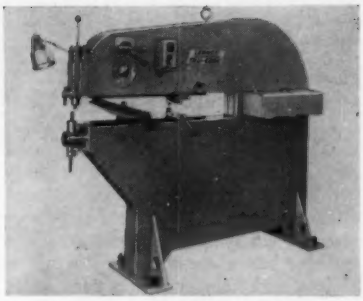
Combined Drill Countersinks

Heavy-duty combined drill and countersinks have design features that contribute substantially to their efficiency and economy in operation. The heavy tapered web and shorter drill length add extra strength to the dull section that minimizes point breakage. With the split point grind, the drill point begins cutting immediately on contact with the work. The drill will not crawl or wander when feed pressure is built up, resulting in greater accuracy in location of center hole. Less thrust pressure is required to penetrate the work, helping to minimize point breakage. The tools are carried in stock both in plain and Bell style.

Q-T Tool Co., 1000 R St., Bedford, Ind. **Circle 564**

Multipurpose Machine

Model TE-250, a shearing, forming and piercing machine, cuts in the center of ¼-inch mild steel plate without a starting hole. Other improved features include a simplified stroke adjustment with positive stroke scale and streamlined design with all controls on one side of the machine for ease of op-



eration. The new model, largest of the line, has all of the operational and safety features of previous models. Maximum edge-cutting capacity is 1 gage in mild steel plate and 5 gage in stainless steel. Throat depth is 49¼ inches, permitting circle cutting to 48 inches.



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diam inside the throat. Model TE-250 operates with a reciprocating upper and stationary lower tool. An infinite range of tool strokes is available from 0.035 through 0.250 inch, with strokes per minute (in relation to material thickness) being automatically regulated when setting stroke length. The machine has a cutting speed of up to 36 fpm, with number of cuts per minute from 1750 to 3500. It cuts straight, circular, inside or irregular shapes, slots and louvers, as well as performing beading, planishing, flanging, edge bending, joggling, nibbling and hole-piercing operations.

Lennox Tool and Machine Builders, Lima, Ohio. **Circle 565**

Production Saw

Designed with a horizontal cutting head to cut with the top saw band, the Continental Production Saw permits the use of 2-inch-wide tungsten carbide-tipped sawbands. It has a 10-hp drive and 16x20-inch capacity.

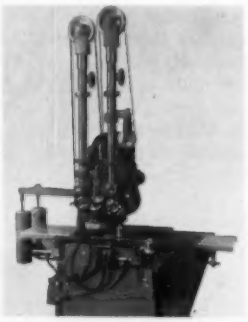
Its features include electrically programmed stock indexing, micrometer length adjustment, automatic chip disposal, overhead mounting of main and outboard vises, servo-regulated cutting rate, planetary chip brush and standardized worktables.



DoAll Co. **Circle 566**

Abrasive Belt Grinder

Available with single or double-spindle assemblies, the Loungway rise and fall abrasive belt grinder automatically rough grinds and finish grinds contour and form parts in one cycle. Workpieces up to 4 x 6 inches long travel on a table operated by air motor and hydraulic check units. The machine is equipped with a floating piston for even pressure on abrasive belts, adjustments for belt alignment and tracking, and a cam-operating, air-powered speed indexing of the table.



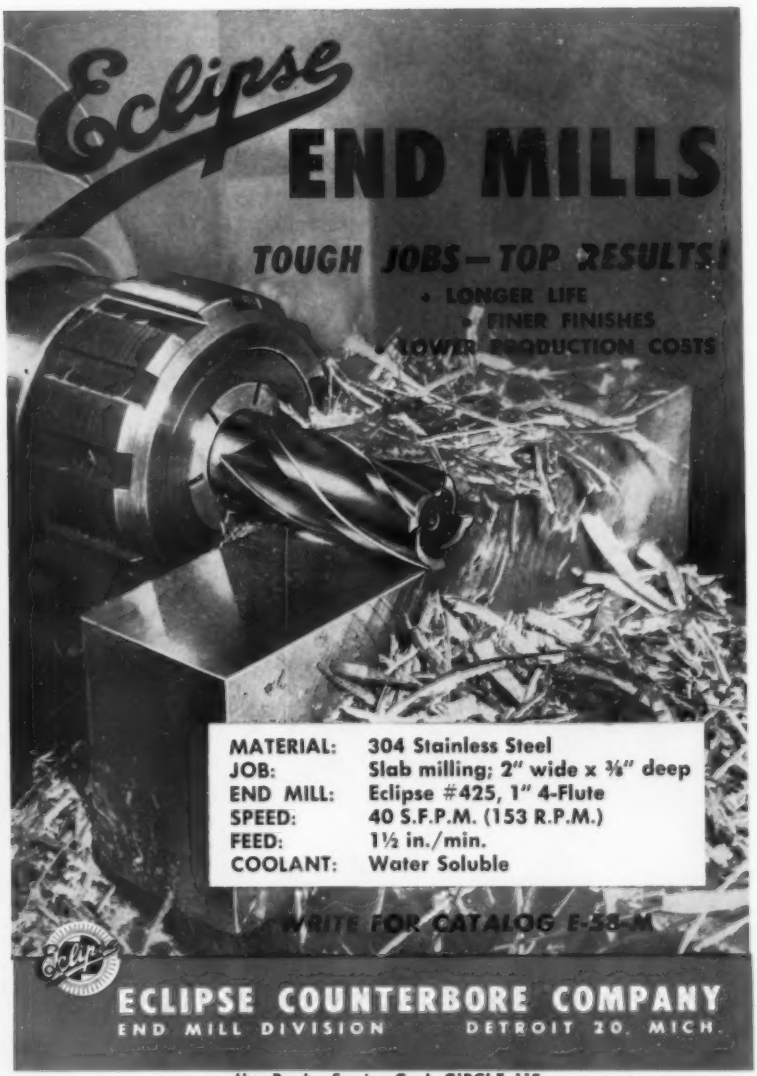
Eastern Machine Screw Corp., New Haven 6, Conn. **Circle 567**

Phosphating Compound

A phosphating compound for simultaneous cleaning and phosphating of iron, steel and zinc has been formulated to meet the exact requirements of more than a thousand metalworking plants and developed as the result of a nation-wide market survey recently completed by the manufacturer. Applied by immersion, spray washer or steam cleaner, the cleaner produces a light (up to 70 mg/sq ft), very tight, smooth and uniform phosphate coating, assures paint adhesion and prevents the rapid postrusting of metals before painting. It is extremely low foaming, low sludging and free rinsing, and requires a minimum of temperature control when used between 140 and 180 F.

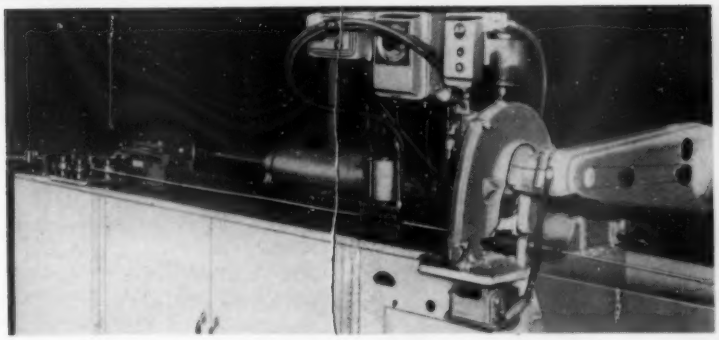
Turco Products, Inc., 24600 S. Main St., Wilmington, Calif. **Circle 568**

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Straightening and Cutting Machine

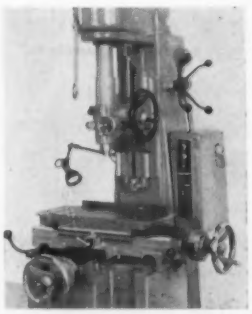


Coiled nonferrous metal and plastic tubing can be straightened and cut in lengths from 1/16 inch to 10 ft with this automatic machine. It accommodates tubing up to 3/8-inch diam and can be adapted to cut up to 1-inch diam round, hex or square bar stock. Tubing can be cut up to rates of 5000 pieces per hour and change-over from one cutting length to another is done by dial in 30 sec.

Precision Parts Co., Inc., Box 149, Haddonfield, N. J. **Circle 569**

Jig Borer

The No. 1½ Moore jig borer, designed for working to split-tenth tolerances, has a three-position clutch. Other features include infinitely variable spindle speeds ranging from 120 to 2400 rpm, the elimination of gibs and overhang, a 10½ x 19½ x 16-inch table, and microsetting of vernier dials. It also has V and flat ways, single lever front and back table clamps, two feeds, 1⅜-inch-diam leadscrews and chrome-plated dials and reference scales.



Moore Special Tool Co., Inc., Bridgeport, Conn. **Circle 570**

Portable Belt Grinder

Combining the backstand idler principle of abrasive grinding with power and portability, this portable abrasive belt grinder grinds and finishes in one operation. Chattering, bumping and bouncing have been virtually eliminated with the resilient rubber contact

TREPANS

- Maximum Diameter — 5/8 inch.
- For fast-production, multi-spindle machines.
- Specially heat-treated, high speed steel.
- With back taper or radial relief.
- Made by specialists in the design of small tools.



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DIRECT READING TO .0002″

with full magnification from zero to infinity



MICRO-ALIGNMENT TELESCOPE

For precise alignment of all points at any distance; for establishing and checking straightness, parallelism and squareness; with full magnification of 32X or 45X, from zero to infinity.

The Micro-Alignment Telescope is the universal precision optical tooling unit for alignment of machine tools, textile and plastic machinery; for shipbuilding, missile launching, aircraft and missile assembly.

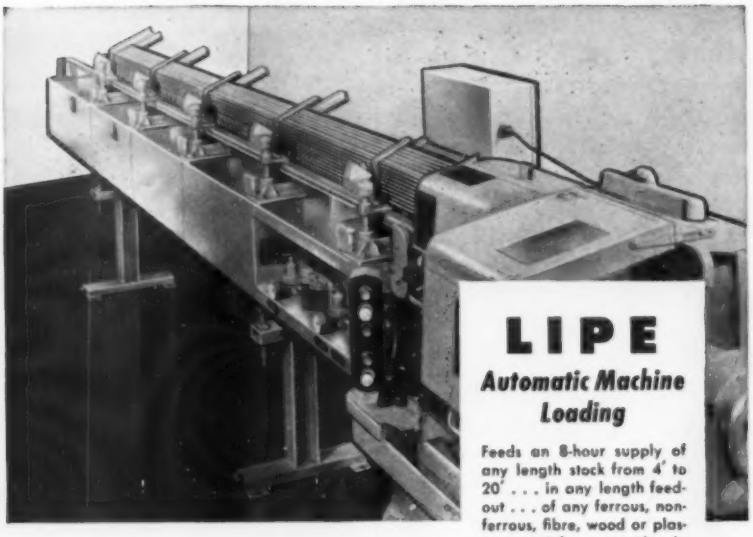
Optical micrometers read direct to .001″ (standard) or .0002″ (special). Right angle eyepiece and auto-reflection and auto-collimation accessories are available.

. . . New

Optical tooling publications: "Penta Prism Behavior" and "Precision Polygons" — a full treatment of the most important optical tooling accessories.

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Continuous Automatic Feed

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LIPE AML Bar Feeds will give you faster, finer production with less scrap and refinishing and a more efficient use of manpower.

They are applicable to a wide variety of machines, including single-spindle automatic screw machines, turret lathes, centerless grinders, abrasive-wheel cut-offs, punch presses, cold headers, die machines and others.

Sold and serviced by franchised distributors in principal industrial areas. Write or wire for complete information.

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PIONEERS IN PNEUMATIC BAR-FEEDING

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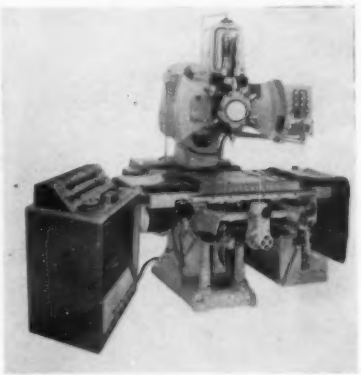
TOOLS of today

wheel which supports the abrasive belt. Designed with a slotted face, the contact wheel keeps the belt cool and lengthens belt life. The belt has a speed of 7000 fpm and the tool is powered by a 2-hp air motor.

Aro Equipment Corp., Industrial Div., Bryan, Ohio. **Circle 571**

Tape Controlled Positioning Unit

The Ferranti FP-22 tape controlled positioning unit, illustrated as demonstrated on a Burgmaster turret drilling machine, positions the workpiece to an accuracy of 0.0005 inch and controls such auxiliary functions as tool selection, coolant flow and spindle speed. The FP-22 is a compact, completely transistorized unit. Its diffraction grating measuring system is independent of the machine's drives so that table position is measured directly, and accuracy



of the system does not depend on the precision of the gearing and lead screws. The unit's floating zero facilitates quick setup with inexpensive tooling, since the reference point may be located on the workpiece rather than locating the work to a specific zero point. Additional flexibility is provided by the manual dial input and position indicators. With these features, work may be interrupted at any point

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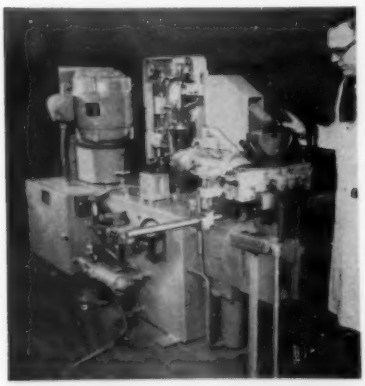
and additional operations performed without loss of synchronization with the tape. Binary-coded decimal tapes are prepared on standard Flexowriter equipment. The format includes a parity check for tape errors, while the

feedback information is continuously checked by means of ternary logic circuits. Another safety feature of the FP-22 is its battery power supply, which guards against troublesome line voltage fluctuations.

Industrial Controls Section, The Bendix Corp., 21820 Wyoming Ave., Detroit 37, Mich. **Circle 572**

Bending Press

Model 5-T bending press increases production 25 to 50 percent by bending two tubes with each stroke. When handling two tubes at once, the Model 5-T is rated at 900 strokes or 1800 bends an hour. With its additional bending capacity, the 5-T handles jobs in the

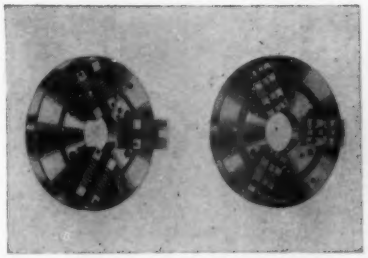


heavier and larger areas beyond the capacity of smaller presses. It can handle two 1-inch OD x 0.065 (16 ga.) wall steel tubes, simultaneously making one bend in each tube. It is particularly suited for the single or multiple bending of U-frames, Z-shaped side frames, or other 2-bend parts. The machine is easily converted for handling single tube progressive bending with capacity up to 1¼-inch OD x 0.065 (16 ga.) steel tubing at typical production rates between 900 and 1000 bends an hour.

Pines Engineering Co., Inc., Aurora, Ill. **Circle 573**

Aluminum Chucks

Teams of aluminum chucks and turning fixtures, designed to eliminate production loss caused while automatic chuckers and turret lathes are down for turning jaws on machines, provide a 40 percent weight saving plus gibbed keyways to take up wear. Illustrated are two types of jaw turning fixtures—serrated master and American Standard tongue and cross key. These fixtures duplicate the jaws of Buck power chucks. They are used in the toolroom

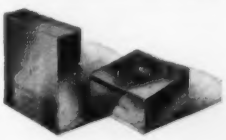


to hold top jaws for machining or grinding after hardening. Final precision adjustment is made on the chucking machine under full air pressure. Precision is within 0.001 inch. The power chucks and jaw turning fixtures in 2 and 3-jaw types are available in sizes from 5⅝-inch diam to 18 inches.

Buck Tool Co., 2015 Schippers Lane, Kalamazoo, Mich. **Circle 574**

Tungsten Arc Welder

The Airco C-Bee Heliweld is a balanced wave, transformer type power source for use with tungsten arc welding equipment. It welds aluminum and



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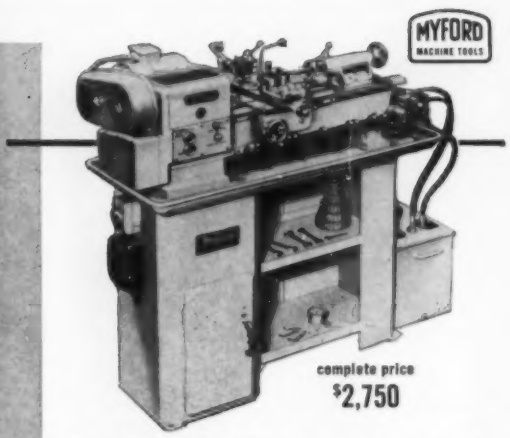
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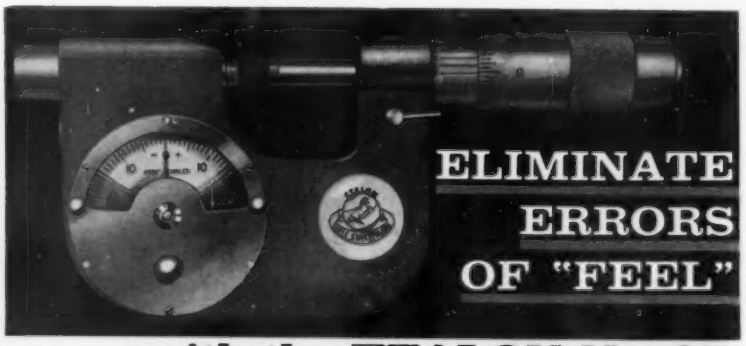
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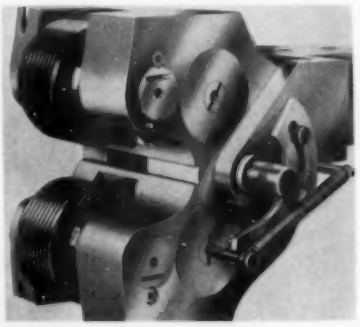
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magnesium, using alternating current. Features include capacitor balancing, high open-circuit voltage for maximum arc stability and five ranges for applications requiring 20 to 400 amp. Amperage output is electrically controlled, permitting remote control with standard accessories. The unit can be used with manual, semiautomatic and automatic welding equipment.

Air Reduction Co., Inc., 150 E. 42nd St., New York 17, N. Y. **Circle 575**

Thread Rolling Attachment

Developed to roll a diametrical range from 1½ to 3¼ inches, the No. 28 Lanroll thread rolling attachment is applicable to turret and tracer lathes and to the larger automatic chuckers and bar automatics. It has a hinged con-



struction, size-adjusting link, and helix-angle bushings that permit helix-angle agreement between the thread rolls and the workpiece.

Landis Machine Co., Waynesboro, Pa. **Circle 576**

Lead Screw Tapping Head

A lead screw tapping head that enables unskilled help to produce precision tapped holes on any drill press features a rapidly interchangeable lead screw, a sensitive cone clutch that runs in oil, and a positive depth control that assures perfect threads even in blind or recessed holes. A hardened precision ground lead screw runs in a special alloy bronze nut that is adjustable to compensate for wear. A rubber flex collet centers taps accurately in relation to centerline of lead screw. High production is possible because the tap-

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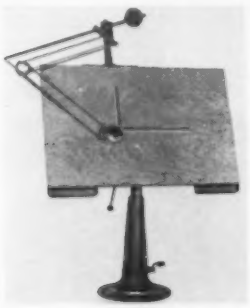


ping clutch reverses approximately twice the speed of input. Tap breakage and work spoilage are minimized because the lead screw, not the operator, guides the tap in and out of the work with only the normal cutting load.

Ettco Tool & Machine Co., Inc. 594 Johnson Ave., Brooklyn 37, N. Y. **Circle 577**

Drafting Table

In order to select the best lighting, the draftsman can rotate this Isis hydraulic drafting table 360 deg around the base. Angle adjustment of the table is from horizontal to vertical. The ver-



tical traverse is nearly 2 ft. The curved surfaces do not catch dust and a low center of gravity permits free placement on the floor.

Isis, Inc., York, Pa. **Circle 578**

Vibration Inducer

This BD-10 vibration inducer weighs 4½ oz. Vibration is generated by a rolling ball driven in an orbit on replaceable raceways of high-alloy steel. Used to bring powdered, particulate or

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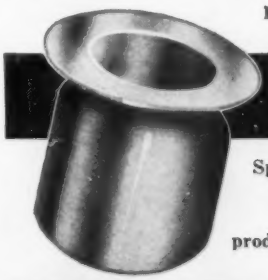
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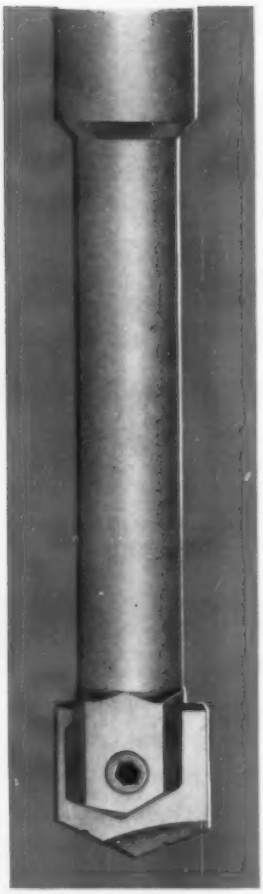
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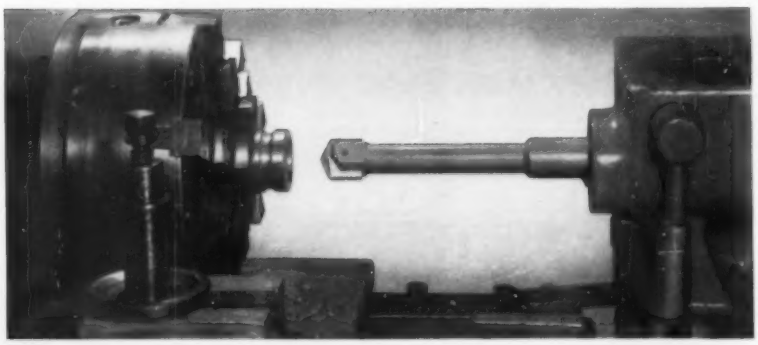
It's a fact! And here's the proof to back up our statement.

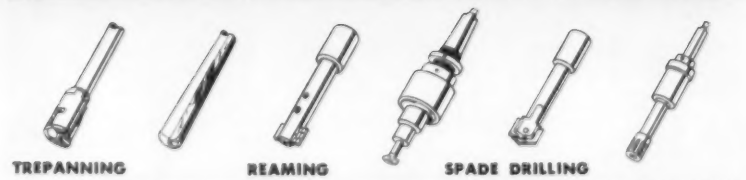
With Madison spade drills, the work is done in one pass from the solid — no need for progressive drilling. Damage to the tool is sharply reduced due to the forced flow of coolant through the Madison tool holder and the rapid elimination of the small C-shaped chips from the work. There's no stopping to remove chips.

You save money because of reduced tool inventories required. One Madison tool holder accommodates a wide range of bit sizes, and spade drills cost much less than twist drills.

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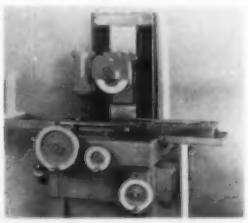
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granular materials out of hoppers and down chutes, the vibrator can handle bins with 4-cu-ft storage capacity. Operation is silent and is safe in explosive atmospheres. The unit, fitted with a replaceable jet for air economy, has an air consumption of 3 cfm (free air at 80 psi) and can operate on pressures of 5 psi.

Martin Engineering Co., Neponset, Ill. **Circle 579**

Surface Grinder

This hand-operated 618-HR Rollerway grinder employs 78 precision-ground and matched rollers to support the table and work. It is equipped with a table locking device and adjustable, spring-loaded bumpers for the stop dog



to contact at table reversal. The snap when reversing the table has been eliminated by incorporating a variable tensioning device and the proper gear ration for turning the handwheel.

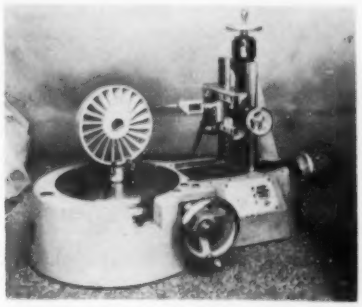
Reid Brothers Co., Inc., Beverly, Mass. **Circle 580**

Direct Reading Contour Measuring Instrument

A direct reading universal contour measuring instrument can simultaneously measure form and thickness in one operation. The low priced quality control instrument is designed to solve the complex inspection problems of parts and components with multifaced, spherical and contoured surfaces. The direct reading instrument can check contour dimensional accuracy to 0.001 or 0.0001 inch on machined, cast or forged parts. It is a measuring instrument which can be used at all stages of complex component development, from the pattern stage to the prototype, to the tooling and on down to finished production inspection. No intricate or time consuming setups are required to

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assure accuracy and uniformity of results. The instrument consists of a rotary unit on which the part to be gaged is mounted and a measuring unit which has three mutually perpendicular slides. Mounted on the slides is a probe, with either a needle, ball or



disk that is brought into contact with the workpiece to establish the polar or rectangular coordinates. Moving one or all of the three precision slides brings the probe into contact with the work. Moment of contact is indicated by a highly sensitive transistorized electronic audio and visual signal.

Turbotronics Corp., E. 193rd and Roseland Ave., Cleveland 17, Ohio. **Circle 581**

Index Table

Milling slots, checking, drilling, grinding, gaging, automatically indexing work between centers can be done with a seven-inch centering fixture provided with the company's 307V index table. The table can be removed for horizontal as well as vertical work and is designed for use on mills as well as grinders. A special fixture allows the

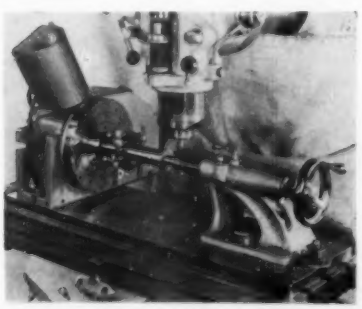


table to index automatically by limit switch and provides indexes to ±0.0003 of true position. The motor operates on 110V, 60 cycle with variable speed control indexing. Milling can be done only in the stopped position. Both external and internal grinding can be done, and a coolant can be used if desired.

M & M Tool & Mfg. Co., 1124 E. Third St. Dayton 2, Ohio. **Circle 582**



ONE MADISON RECESSING TOOL DOES THE WORK OF TWO...WITH SNAP-ON ADAPTOR!

New, snap-on work pilot adaptor converts the tool for piloting either in the work piece or in a fixture, enabling you to use the tool in any standard shop equipment. For even greater versatility, a replaceable nose piece permits the rapid changeover, when piloting in the work, from one piece part to another of different I.D. dimensions.

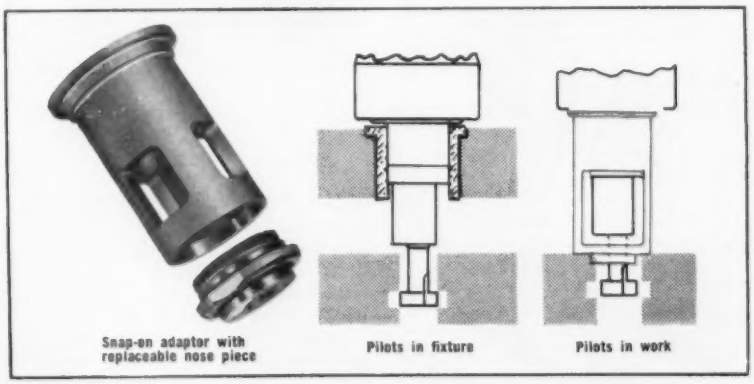
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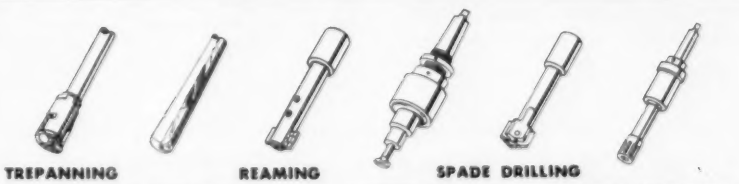
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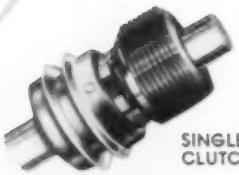
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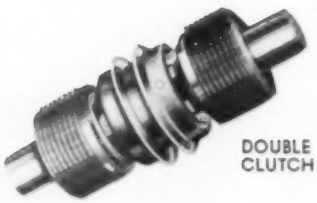
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who's meeting and where

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Nov. 3-4. AMERICAN PRODUCTION AND INVENTORY CONTROL SOCIETY. Third Annual National Conference and Technical Exhibit. Sheraton-Cadillac Hotel, Detroit, Mich.

Nov. 7. SOCIETY OF PLASTICS ENGINEERS. Technical conference on automation in injection and compression molding. King Edward Sheraton Hotel, Toronto, Ontario.

Nov. 8-9. AMERICAN SOCIETY OF TOOL AND MANUFACTURING ENGINEERS. Seminar on standards and standardization. Warwick Hotel, Philadelphia, Pa.

Nov. 8-10. MATERIAL HANDLING INSTITUTE. Regional show. Kentucky Fair and Exposition Center, Louisville, Ky.

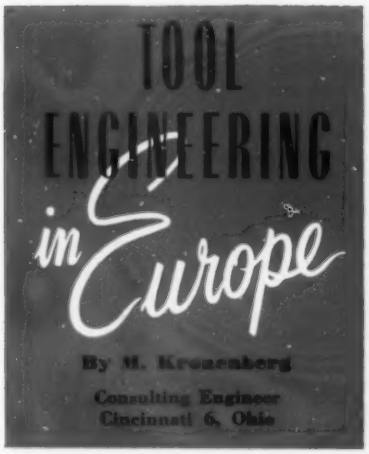
Nov. 8-11. SOCIETY OF DIE CASTING ENGINEERS. First National Die Casting Exposition and Congress. Artillery Armory, Detroit, Mich.

Nov. 14-16. STEEL FOUNDERS' SOCIETY OF AMERICA. Sessions on cores and core binders, welding and hardfacing, ladle and pouring practice, process and control, and fundamentals or risering steel castings. Hotel Carter, Cleveland, Ohio.

Nov. 14-18. AMERICAN SOCIETY OF TOOL AND MANUFACTURING ENGINEERS. Western Engineering Conference and Exhibit. Los Angeles, Calif.

Nov. 16-18. PORCELAIN ENAMEL INSTITUTE. Twenty-second annual shop practice forum. Papers on base metals and fabrication; low-temperature enameling; materials, equipment and processing; test methods and controls; and one-coat enameling. University of Illinois, Urbana, Ill.

Nov. 27-Dec. 2. AMERICAN SOCIETY OF MECHANICAL ENGINEERS. Winter Annual Meeting. Statler-Hilton Hotel, New York, N. Y.



Drop Forging Automation

Fully automatic manufacturing—from bar stock to finished forging—has been accomplished in a German plant, according to an article by H. Haller in *Werkstatt und Betrieb*, Vol. 93, No. 2, 1960, under the title "Zur Automatisierung in der Gesenkschmiede."

Haller points out that drop forging has not yet reached the stage of automation possible in other manufacturing fields because of the difficulty of conveying stock and forgings into and out of standard forging hammers. Extremely high investments would be required to incorporate standard hammers in a transfer line.

Presses have significant advantages over hammers in the field of automation, although horizontal counter-blow hammers (impact hammers) have come into use. Needed developments for the automation of drop forging plants are the perfection of a practical conveyor system, the adoption of program-controlled hammers and the use of gravity discharge furnaces in conjunction with power operated handling equipment.

The author summarizes his findings as follows:

1. Automation in the drop forging shop must overcome unsolved problems of transportation.
2. Automatic forming by horizontal or vertical forging presses promises faster results and should be further developed.
3. The design of forming machines requires scientifically developed data with regard to power, work, deformation resistance, effect of temperature, type of work material, friction and other such quantities which affect the flow of the work.
4. Force and speed of the machines must be adjustable. (The kinetic energy of each stroke can be adapted to the requirements of a programmed automation in the case of the screw press.)

The article compares German and American developments, covering ball bearing forgings, seamless rings and the use of horizontal upsetting for the heading of torsion bars for automobiles.

Heavy Broaching

The amount of stock removed by a broaching operation should not exceed about ¼ inch with conventional broaching machines, according to K. Hoffman, whose opinion appears in an article in *Werkstatt und Betrieb*, Vol. 93, No. 4, 1960, p. 188 ff. The title: "Aussen Raemmaschinen fuer grossen Werkstoff Abhub."

Hoffman points out that some recently developed broaching machines permit changing the relative position of tool and work quickly; others allow a number of broaching tools (mounted on a vertical slide) to be placed into consecutive engagement with the same workpiece.

Two examples are given: one covering broaching of surface grooves of considerable depth into a gear and the other covering the broaching of supercharger shafts. A program-controlled positioning system that permits two depth positions in three angular positions is used for the gears. The complete operating cycle of the machine is discussed in the article. The tools are advanced after the initial cut has been finished. A second cut is then taken. To eliminate the danger of tool jamming (caused by chips clogging the teeth) the machine is equipped with rotating brushes. The brushes contact the teeth above the outlets of the cutting fluid supply lines and clean the teeth with the aid of the cutting fluid.

When broaching deep cuts, as in the supercharger shafts, it is impractical to shift the work relative to the tool. In this machine, broaching tools of different shape engage the workpiece consecutively.

Grinding Wear

A grinding wheel may wear in four different ways, says K. Brueckner in *Industrie Anzeiger*, Vol. 82 (36), 1960, p. 553-558. The title of his article is: "Betrachtungen zum Verschleiss Vorgang beim Schleifen."

The wear may be due to weakening through pressure, splitting of crystal groups, partial breakdown of abrasive particles and complete breakdown of the particles. The author used a diamond to make grooves to a depth of 0.0008 inch in the grinding wheel. Wear parameters of the wheel in relation to the metal removed by the grinding operation can be computed more accurately by comparing the results of the indentation method with measurements of radial wear. The author concludes that the wear is heavy at the start of the grinding operation and that the wear curve flattens out as the grinding continues.

Grinding wheel wear conditions are not consistent in this region, depending on the metal removal rate and other factors. By means of a new measuring process, the grinding wheel surface could be tested and the profile shown at various stages of wear.

Stresses After Machining

Residual stresses set up in the workpiece by machining operations will require considerably more attention in the years to come because of the intensified use of negative rake angles on tools and the necessity of avoiding and eliminating breakdown of manufactured parts.

D. D. Papshev has investigated the effects of the main factors involved in metalcutting operations—cutting forces and tool geometry for example—on the type and magnitude of the residual stresses and the resulting dynamic strength of the workpieces. The results are published in *Stanki i Instrument* and translated into English in the April issue of *Machines and Tooling*, Vol. 31, 1960. The title: "Effect of Residual Stresses on the Dynamic Strength of Steel."

The author used mostly annealed steel as a test material with a constant depth of cut of 0.019 inch. Feed rates and tool geometry were varied. Tests were run at a low cutting speed of about 49 fpm, a medium speed of about 263 fpm, and a high speed of 1040 fpm.

Residual stresses in turning and in metalcutting in general are developed as a result of two simultaneous actions—plastic deformation of the surface layer of the workpiece by the cutting force and surface heating due to the cutting temperature.

Residual stresses developed in turning show a significant effect on the dynamic strength of the workpieces. It must be kept in mind that tensile stresses reduce the strength and are therefore undesirable, while compressive stresses increase the dynamic strength (endurance limit).

When turning under conventional conditions, residual tensile stresses are set up. The author says that he found values between 11,400 psi and 66,000 psi, which seem to be rather high. The depth of the residual stresses, that is to a region where tensile stress changes into compressive stress, is not more than 0.0001 to 0.0006 inch. An increase in cutting speed to 265 fpm reduced the tensile stresses, while a further increase had less effect on them. Reduction of the tool nose radius helped in reducing tensile stresses.



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The effect of negative rake angles is very interesting. The author reports that a rake angle of —30 deg produced compressive residual stresses at a cutting speed of 1040 fpm. The reason for the various effects of cutting speed and rake angle of the tool on the residual stresses can be found in the plastic deformation taking place during cutting. Increases in speed produce a more uniform plastic deformation, reducing the stretching of the surface layer. Annealing removes part of the residual stresses, which is desirable in the case of tensile stresses but not in the case of compressive stresses.

Work hardening caused by machining increases the endurance limit but is eliminated by annealing. When using negative rake angle tools the effect of the compressive residual stresses is apparently so great as to overcompensate the weakening effect of the plastic deformation and also the effect of the cutting temperature, which cannot completely remove the compressive residual stress.

The endurance limit when cutting at 1040 fpm using a 0 deg rake tool was 43,000 psi before annealing and 41,000 psi after annealing. In the case of the negative rake tool the endurance limit was 48,000 psi before annealing and 40,600 psi after annealing.

Belt Grinding Forces

Belt grinding processes are difficult to study because of the shape of the abrasive grains and the random distribution of the grain in the adhesive bond. K. S. Mitrevich, a Russian, has investigated belt grinding processes and reports on them in *Stanki i Instrument*. An English translation appears in *Machines and Tooling*, Vol. 31, No. 4, 1960.

The structural system of an abrasive belt corresponds to that of a flexible tool. During the grinding operation, the belt is stretched. The elongation depends on the properties of the cloth, feed, speed, belt tension, cooling and so on.

Operation of an abrasive belt is divided into three periods by the author. During the first period, the belt is plastically deformed. Deformation is accompanied by changes in grain orientation, fracture and chipping of grains. The second period is a relatively stable condition, gradually lowering the elastic properties of the belt and reducing its strength. During the third period the belt loses most of the grains, perhaps due to knocking caused by the seam, which may now be thicker than the the rest of the belt.

An apparatus was built by the author to investigate the abrasive belt grinding process illustrated in the article. Strain gage dynamometers were used for measuring the forces involved. Other instrumentation is described.

The author concludes that a rapid increase in the radial cutting force component indicates that the belt has become unsuitable for further use. The coefficient of friction of the cloth backing and the adhesive bond varies between 0.18 and 0.25. Cutting forces in the direction of belt motion and square to it vary in inverse proportion to the belt speed. The best belt speed for grinding alloyed steels and high temperature alloys is 5000 fpm. Increases and decreases in belt speed cause premature wear of the belt and reduce the economical advantages of the process. Increasing the belt tension causes an increase in the cutting forces and productivity.

Belt life is increased with an increase in belt tension up to a limit above which the belt life drops. Optimum belt tension, using a belt with a hide glue bond (and oil cooling) is approximately 40 lb per inch of belt width. Belt tension is directly proportional to the rupture strain of the belt.

Chip Formation and Surface Finish

An interesting contribution to the problem of chip formation was presented in a paper read before the tenth annual meeting of the International College for Production Engineering Research at Brunswick, West Germany, in September 1960. The paper was given by M. Ehrenreich and S. Ilani of the Israel Institute of Technology. Its title is "Spanverformung und Oberflaechenguete beim Langdrehen" ("Chip Formation and Surface Finish in Longitudinal Turning').

In tests, the authors studied the phenomena associated with chip formation at conventional cutting speeds, for example, the change in the shape of the chip cross section that occurs as the chip flows over the tool face. With a round nosed tool, the authors observed that the portion at the tool nose of the chip is straightened by the tool face so that the cross sectional shape of the chip as it escapes from the tool does not correspond to the theoretical shape.

Straightening the curvature at the tool nose of the chip has the same effect as widening the cut. This increase in width becomes more pronounced as feed is made smaller in the comparison with the tool nose radius. The chip contacts the workpiece in the groove formed during the previous turn. Under identical conditions the contact always occurs at the same point, resulting in surface scratches on the workpiece. These scratches can also be observed with no built-up edge.



William G. Bancroft has been appointed the new manager of the Grinding Wheel Plant, Products Div., The Cincinnati Milling Machine Co. He succeeds Maurice Gormly who is now manager of the division. Bancroft, who has been with Cincinnati Milling since 1953, was formerly manager of manufacturing engineering.



Carleton M. Sloat has been appointed works manager of Morris Machine Works. He will be responsible for all phases of manufacturing at Morris. A graduate of Rensselaer Polytechnic Institute, Morris has worked for Carrier Corp. and Curtiss Wright Corp. as project engineer and served as chief engineer for Lion Fastener Co.

Men at Work

R. J. FORESMAN has been named a vice president of Michigan Abrasive Co. For many years he was vice president and director of Midwest Abrasive Co. and more recently served as vice president of American Lincoln Corp.

HOWARD B. CARROLL, JR. has been elected president and general manager of the Sheldon Machine Co., Inc. Since 1956 he has held the position of vice president. He is a Yale graduate.

WILLIAM A. STRAUSS, JR., formerly of Beemer Engineering Co., has been named general manager of Chemical Micro Milling Co., a division of the Beck Engraving Co. The company produces precision parts by chemical etching, electrotype etching and electrodeposition, using a photographic process.

HAROLD H. MITCHELL has joined the King Machine & Manufacturing Co. as vice president. Formerly, he was chief engineer of the Kelman Power Circuit Breaker Div. of the I-T-E Circuit Breaker Co.

MICHAEL KOVAC, JR. president of Productive Tool Service, Inc., has announced the appointment of ROBERT F. MYERS as sales manager. Mr. Myers was formerly sales manager with Lees-Bradner Co. and sales manager, Machinery Manufacturing Div., The Motch & Merryweather Machinery Co. Myers has already assumed his new duties.

G. KEITH BOGERT has been named manager of manufacturing at Wilkerson Corp. Bogert has served as production manager or supervisor of production and process manufacturing operations in several plants, most recently as superintendent of fabrication and processing for Ramo-Wooldridge Div. Under Bogert's direction, Wilkerson Corp. will move into new facilities now under construction in Englewood, Colo.

HOWARD A. BAXTER has been elected vice president in charge of engineering for Norma-Hoffman Bearings Corp. He



Henry M. Crossen has been appointed vice president of manufacturing of the Clearing Div. of U. S. Industries, Inc. Crossen joined Clearing as director of administration late last year, later becoming director of manufacturing. Before that he was manager of plant and manufacturing engineering for the plants of the Ford Motor Co. Metal Stamping Div.



Ira Kamen, space technology expert and authority on electronics systems, has been elected president of Portland Industries of South Portland, Me. Kamen resigned his post as vice president of General Bronze Corp. to head the Portland firm. Kamen plans expansion of the firm for complex electronic and nuclear programming and production.



Rodney E. Hanes has been appointed vice president-operations of the Foundry & Mill Machinery group of Blaw-Knox Co. An important responsibility of his new position will be supervision of the large modernization program now under way at the plants of this group. Hanes joined Blaw-Knox in 1952 and was once chief of manufacturing at Detroit Arsenal.



Horace Frommelt, a specialist in metal removal, has been appointed director of manufacturing research for Ferro Powdered Metals, Inc. Frommelt has been director of the Spring Garden Institute — Metal Removal Center in Philadelphia, and was formerly head of mechanical engineering at Marquette University. His articles have appeared in this magazine.

joins the company after seven years with American Machine and Foundry Co.'s Greenwich Engineering Div., where he was director of technical services. He graduated from Iowa State.

CHARLES E. PETERSON has been named division manager in charge of the Mackintosh-Hemphill Div. of the E. W. Bliss Co. He succeeds J. R. PATTERSON as chief executive of the division. Patterson was recently elected president and chief executive officer of E. W. Bliss. Prior to his present appointment, Peterson was manager of manufacturing operations for Mackintosh-Hemphill Div.

RICHARD D. SEVICK, director of research and development of abrasive cutting wheels for the Allison-Campbell Div. of American Chain & Cable Co., Inc., has assumed the added responsibility of supervision of abrasive cutting machine development for this division.

FRANK W. RICKARD has been elected a group vice president of Borg-Warner Corp. He joined the company in 1953 as director of manufacturing services.



Robert L. Walker has been appointed manager of the Cleco Div. of Reed Roller Bit Co. In his new post, Walker will coordinate activities of the division, which is expanding. Walker is a graduate of Georgia Tech and also attended Pratt Institute in Brooklyn. Prior to his recent appointment, he coordinated engineering operations with sales activities.

JAY C. WARNER has been appointed assistant to the director of manufacturing of Allis-Chalmers International. Since 1955 Warner had been territory manager for engineering products in middle and east Asia and Oceania. W. C. GARDNER has been named to succeed Warner as territory manager. Warner joined Allis-Chalmers in December, 1944, as a regional sales supervisor in the export department, Industries Group, after spending 15 years in the export field in the Far East and Latin American countries.



The appointment of Adolph R. Schaub as vice president of manufacturing of L. J. Wing Mfg. Co., Div. of Aero Supply Mfg. Co., Inc., Linden, N. J., has been announced. He has been manager of manufacturing since joining Wing in January, 1960. Schaub came to Wing from M. W. Kellogg Co., where he served in many engineering capacities.

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Men at Work

ERNEST S. FRENS is the new manager of manufacturing engineering at the General Electric Co. foundry department. Frens is a 1953 graduate of Michigan State University who has worked as a casting design engineer at G. E.'s Everett, Mass. and Schenectady foundries.



Sandvik Steel, Inc., Fair Lawn, N.J., has announced the appointment of Ray F. Nelson as manager of the company's steel department. He will be in charge of the sales, warehousing and processing of Sandvik cold rolled spring steels, wire and tubing throughout the U. S. He was formerly with United States Steel Corp.

Gleason Works has announced a number of promotions. ALFRED J. MURRER has been named assistant factory manager. WALTER E. ANDRUS becomes assistant production manager. DONALD L. WHITMORE, product development engineer, has been assigned the additional responsibility of liaison engineer for Gleason Works Ltd. in England. JOHN H. FOSTER assumes the position of superintendent of the Cutter Div. HAERLE D. WESGATE is advanced to superintendent of the foundry. OLIVER F. BAUER has been named chief designer of the Auxiliary Machine Group and EARL D. DAMMERT becomes chief designer of the Universal Machine Group. PHILIP H. GOELTZ is now chief standards engineer and HERMAN A. MALE is chief designer. Production Machine Group.

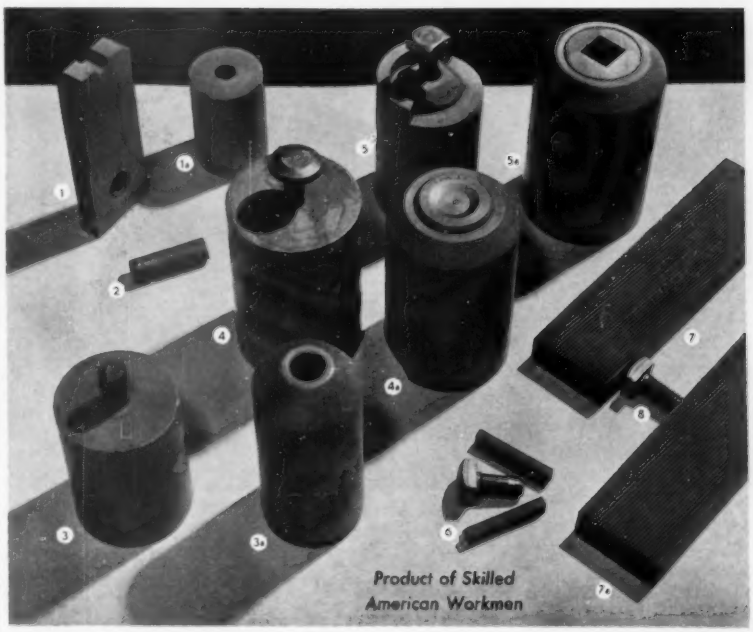
LAWRENCE M. WEITZEL, president of Mechanical Specialties Co., is a member of the United States Trade Mission to France, which departed last month for six weeks of meetings with French businessmen, industrialists and government officials. Weitzel will represent the interests of the metalworking and tooling fields on the mission.

WALTER HANSTEIN, JR. is now associate director of engineering, Burroughs Corp. Previously manager of the machines research department at Burroughs' Paoli, Pa. research center, Hanstein will be responsible for engineering coordination of all Burroughs-produced general products. Before joining the company in 1952, Hanstein was a project engineer with Baldwin-Lima-Hamilton Corp., Eddystone, Pa.

Appointment of W. BLAKE TRIPP as plant manager has been announced by CLYDE KAUNITZ, president, United Welders, Inc., Bay City, Mich. In his new position, Tripp will be responsible for engineering and manufacturing the special-purpose welding and assembly machines made by the company. Tripp comes to United after nine years with Avco, where he was chief industrial engineer for special projects.

MICHAEL L. MANDEVILLE has been appointed president of the International Div., U. S. Industries, Inc. He had been executive vice president of the division. He succeeds R. S. WRIGHT, who was recently appointed vice president of the parent company, in charge of international trade.

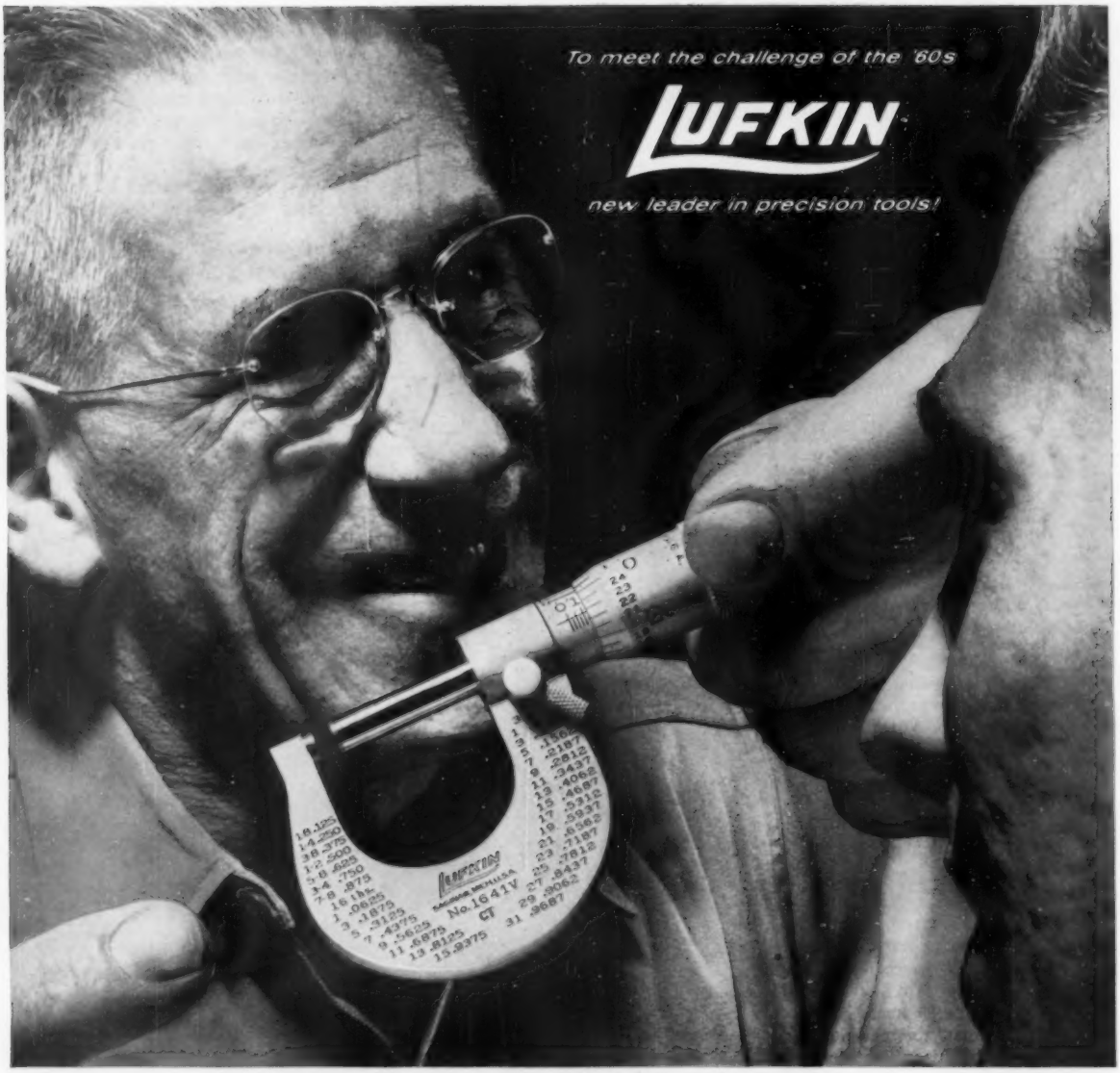
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5a — Trim die COLUMBIA EXTRA HEADERDIE with low carbon 18-4-1 high speed steel insert
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Field Notes

Racine Hydraulics & Machinery, Inc., Racine, Wis., has announced a cross-licensing agreement with **Vickers-Armstrongs (Engineers) Ltd.,** a wholly owned subsidiary of Vickers, Ltd., of London, England. The reciprocal agreement adds large, high pressure equipment to the Racine line of hydraulic products and gives the company complete coverage of all industrial hydraulic applications. During the next year the Racine plant will commence the manufacture of certain elements of the Vickers-Armstrongs line. Vickers-Armstrongs will manufacture Racine hydraulic equipment at its Weymouth plant in England and, through Racine Hydraulics' Swiss subsidiary, will distribute it throughout the British Commonwealth and European countries.

Nationwide Leasing Co., Chicago, is offering a special R & D (research and development) Lease Plan to machine tool companies engaged in government contract work. The lease has terms of from three to five years and may range from $25,000 to $1 million or more. A cancellation clause, the first to be offered in lease contracts, is available. Types of equipment that can be leased include: environmental test equipment, electronic gear, business machines and office equipment, machine tools, as well as general production, laboratory and processing equipment. "The purpose of this R & D Lease Plan is to enable companies to participate in the great research and development program now underway, without tying up the working capital they need for their normal operations," said Robert Sheridan, president of Nationwide Leasing Co.

new facilities

Polytechnic Institute of Brooklyn's new Graduate Center, Long Island's first graduate school of engineering, is now under construction in Farmingdale, N. Y. The facility, with attendant research laboratories, will cover 25 acres of land donated to Polytechnic by **Republic Aviation Corp.** The approved plans call for two buildings with a total of 65,000 sq ft of floor space. The main building will provide nine classrooms with seating capacities ranging from 30 to 200 students, a science library for 20,000 volumes, administrative offices, dining area, lounge, meeting room and 12 laboratories for research in aero-space engineering, electrical engineering, physics and electrophysics. The second building, a steel frame structure expandable in any direction, will house three laboratories for research in aerodynamics and high power electronics. According to the construction schedule, classes at the center will begin in the fall 1961 semester.

Wilkerson Corp., Denver, manufacturer of compressed air products, is constructing a quarter of a million dollar plant in suburban Englewood. The 20,000 sq ft building is being constructed of reinforced concrete, built by the tilt-up method. After erection of the structural steel parts, the precast concrete wall slabs are hoisted into place. The building will be expandable to 60,000 sq ft of floor space.

moves

Freeland Gauge Co. has moved to a new plant at 13300 Foley Ave., Detroit, Mich. The new building will provide more storage space and will enable the company to put its expansion plans into effect.

The Carbide Tool Co., Detroit maker of special carbide tools for blueprint, has moved into a new plant at 14050 Oakland in Highland Park. The one-floor production area comprises 13,200 sq ft, as compared with 8000 sq ft at the firm's former location. Among innovations in the new plant, president Alfred R. Conti announced, are an integrated electrical heat-treat operation and piped music for the 70 employees.

Raymac Div. of **Dexco Corp.** has moved to 15778 Telegraph Rd., Detroit. The division manufactures solid carbide cutting tools. Dexco's extractor department, specializing in repair work on expensive machined parts and hardened steels, occupies new quarters at 7744 Greenfield Rd., Dearborn.

Fen-Thread Machine Co., Inc., has moved its production facilities to larger headquarters at 1910 N. Marshall St., Philadelphia. The new plant provides more efficient shipping and receiving facilities, better lighting and larger manufacturing space than the former facility provided.

acquisitions

The Electric Autolite Co., Toledo, has acquired the **Marshalltown Mfg. Co.,** Marshalltown, Iowa. The Iowa firm, manufacturers and distributors of pressure gages, dial thermometers, glass tube thermometers and hydrometers, operates two plants in Marshalltown. The acquisition involves no change in personnel, management or field representatives, stated Autolite president R. H. Davies.

The acquisition of **Gemco, Inc.,** Los Angeles, has expanded the missile and aviation activities of **Hupp Corp.,** Cleveland. Gemco actuator devices utilize explosives to separate a rocket or missile's propulsion stages in flight or to eject a pilot capsule, fuel tank or bomb pylon from a manned aircraft. Gemco also makes missile and aircraft ground-handling equipment, hydraulic components and electronic materials. John O. Ekblom, Hupp chairman, announced that the new acquisition will be operated as a wholly owned subsidiary under present management. Hupp's first manufacturing location on the West Coast, Gemco complements the activities of Hupp Aviation Div., Chicago, which is engaged in aviation-missile subcontract work and the manufacture of proprietary hydraulic products. This is Hupp's seventh acquisition in the past 18 months.

new activities

Star Cutter Co., Farmington, Mich., has purchased from **Baker Brothers, Inc.,** Toledo, the Baker line of keyseaters, profile grinders and keyseater cutters. The purchase includes all machine part stocks, cutter stocks, cutter bar stocks, machines in-process and all patterns, jigs, fixtures and special tooling for producing the machine tools. According to Star Cutter Co. president

Norman L. Lawton, the acquisition of the line was made in accordance with company plans to expand activities in the machine tool field. Within the past six months the plant facilities have been expanded 50 percent to provide a total of 50,000 sq ft of floor space.

Pratt & Whitney Co., Inc., of West Hartford, Conn., has formed a triple arrangement with **Innocenti S. G.** of Milan, Italy, and **Mitsubishi Ship Building & Engineering Co., Ltd.,** of Tokyo, Japan, announced Pratt & Whitney president Jacob J. Jaeger. Under this arrangement Pratt & Whitney will distribute the larger boring mills made in Milan by Innocenti and the smaller models of the milling, boring and combined machines manufactured by Mitsubishi in Japan under license from Innocenti. Jaeger noted that this is the latest step in Pratt & Whitney's world-wide marketing program, formulated about a year ago in consonance with a similar program being developed by its parent corporation. Fairbanks Whitney Corp.

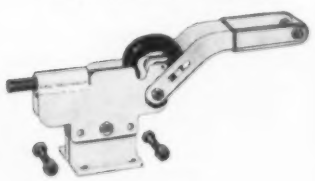
National Broach & Machine Co., Detroit, has formed an associate company in Coventry, England, to manufacture, sell and service gear production equipment, super precision ball screws and precision boring heads. The new company, Precision Gear Machines & Tools Ltd., will serve British, European and world markets. Walter S. Praeg, National Broach president, explained that the reason for the formation of the new company is the cancellation and termination of all previous licensing arrangements in England. The firm will be operated as an independent company and will have a sales force throughout the world. The English plant is being equipped with American machine tools.

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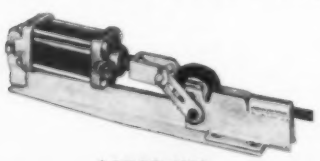




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name changes

The American Brass Co., Waterbury, Conn., manufacturers of copper and brass mill products, has officially changed its name to **Anaconda American Brass Co.** "Since the end of World War II there has been a decided trend in our business toward advertising, marketing and packaging our goods under the brand name Anaconda, and it is only common sense that we identify our brand name with our company name," said Richard M. Stewart, company president.

The Formed Steel Tube Institute, Cleveland, has changed its official name to **The Welded Steel Tube Institute.** A nonprofit organization, the Institute was established to encourage research and development, foster efficient production, inform member firms of technical advances in the industry and to explore new markets and product applications.

Esco Corp. is the new name for a Portland, Oregon firm formerly known as Electric Steel Foundry Co. The name-change has been under consideration for some time because of Esco's expansion into fields other than the foundry business. The company's products have been marketed for many years under the trade name Esco.

association news

Automotive Tool & Die Manufacturers Association, founded in 1933, has been renamed **Detroit Tooling Association.** Members include 160 manufacturers of dies, jigs, fixtures, molds, gages, tools, special machinery and related products as well as suppliers of die tryout, machining, experimental and designing services. The new name was selected because all of the member companies are located within the Detroit area.

Members of the **Instrument Society of America** elected officers for the year 1960-61 at their annual meeting in New York, held in conjunction with their Instrument-Automation Conference & Exhibit. Dr. Ralph H. Tripp, Huntington, L. I., assistant director of Flight Test Div., Grumman Aircraft Engineering Corp., Bethpage, L. I., assumed presidency of the Society. Philip A. Sprague, president of Hays Corp., Michigan City, Ind., was chosen president-elect-secretary. Elected treasurer was John C. Koch, Fort Eashington, Pa., executive vice-president of Conoflow Corp., Philadelphia.

Henry T. Heald, president of The Ford Foundation, has been chosen for honorary membership in the **American Society of Mechanical Engineers.** The award is given "for effective and faithful service to the engineering profession and to the public." Heald will be honored at the Society's winter annual meeting in New York this month. He will be cited "for outstanding accomplishment as an educator and for public service to his city, state, and nation."

expansions

J. C. Miller Div., Hanson-Van Winkle-Munning Co., Grand Rapids, Mich., has announced the completed expansion of its manufacturing facility. By the addition of reactors, filtration equipment and mixing equipment, the company has increased the monthly production capacity of the plant by a factor of three.

Anticipating that industry shipments of commercial computer equipment will increase 33 percent within two years, **General Electric Co.'s** computer department, Phoenix, has announced plans for opening 11 new data-processing centers and 10 additional sales offices in major cities across the nation. The department presently operates two data-processing centers and 16 sales offices. Five data-processing centers will open next year and the remaining six, during the first half of 1962. The new sales offices will be opened early next year.

awards

The Franklin Institute has awarded Elliott Cresson Medals to Dr. Hugh L. Dryden, Washington, D. C., deputy administrator of the National Aeronautics and Space Administration, and to Dr. Arpad Ludwig Nadai, Pittsburgh, formerly a consulting mechanical engineer for Westinghouse Research Laboratories. Dr. Dryden was honored for "his many scientific and practical contributions to the theory and application of aerodynamics, which greatly advanced the art of wind tunnel and aircraft design, and for his guidance of and personal contributions to the design and development of the world's first automatic radar homing guided missile." Dr. Nadai was recognized for "his pioneering work in the field of elasticity of materials and in plastic flow through many research contributions, for important educational activities and for his authoritative treatises."

The Henry Marion Howe Medal, the **American Society for Metals'** oldest honor, was awarded to Dr. John B. Clark, research engineer at Dow Chemical Co., Midland, Mich., and Dr. Frederick N. Rhines, head of Metallurgical Research Laboratory and research professor of metallurgy at the University of Florida in Gainesville. Established in 1922, the medal honors authors of the most outstanding Metal Congress technical paper.

New ARMSTRONG Swivel Pad can't come off



Now ARMSTRONG deep throat "C" Clamps have the new (Pat. apd. for) ARMSTRONG Ball-joint Swivel Pad. This "C" Clamp pad, developed by ARMSTRONG Engineers, is tougher than any on the market. Rigorous testing in our own plant first proved this fact, and field tests in factories throughout the country have confirmed our own test results.

Here's Why it's STRONGER . . .



The lip of the opening in the ARMSTRONG Ball-joint Swivel Pad is undercut so that when the ball of the screw is inserted, and the lip is permanently forced down, a solid steel wall is formed, inside the pad cavity, completely encircling the ball.

This wall of steel makes it impossible for the pad to come off the screw during normal use. In fact, our tests have proved that it is virtually impossible to intentionally knock the pad off with a hammer —yet the pad is free to swivel through an arc of approximately 40°.

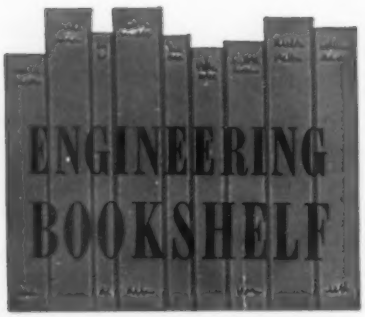


Call your ARMSTRONG Distributor

Your ARMSTRONG Distributor can offer delivery from stock on this "400-Series" deep throat, drop-forged "C" Clamp with the new Ball-joint Swivel Pad. He also carries in stock the other styles of clamps in the ARMSTRONG Line—the broadest line of drop forged "C" Clamps.

ARMSTRONG BROS. TOOL CO., 5257 W. ARMSTRONG AVE. CHICAGO 46, ILLINOIS

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AUTOMATION AND THE WORKER—*By Floyd C. Mann and L. Richard G. Hoffman. Published by Henry Holt and Co., Inc., 383 Madison Ave., New York 17, N. Y. Price $4.50. 233 pages.*

Automation's impact upon labor and certain aspects of labor-management relations is analyzed in this book. To make the analysis scientifically valid, the authors have examined a series of identical problems in two plants within a single company. One plant is modern but conventional in operation — the other, completely automated.

The theme of the book is that, although the end products of both plants are identical, their respective labor forces react differently to similar problems. Workers in "Advance," the pseudonym given the automated plant, are more complete social beings showing a greater degree of interdependence than those of "Stand," the conventional plant. This has resulted partly from management's dissolution of the traditional and often artificial classifications of labor according to skills and partly by a general reorganization of management's responsibilities. Significantly, labor-management relations are better in Advance.

The influence of other factors such as job training and adjustment, shift work and worker environment, and the philosophy of management in both plants is evaluated. Although the authors make no attempt to draw an invidious comparison between them, Advance emerges as an obvious social and productive improvement over Stand.

METALCUTTING BIBLIOGRAPHY—*Published by the Metalcutting Research Project of the ASTME Research Fund. Price $20. 1000 pages.*

Researched and compiled by the John Crerar Library under the auspices of ASTME's Research Fund, this bibliography presents a wealth of information on metalcutting operations. Nearly 6000 abstracts representing a distillation of over 18,000 magazine articles, technical papers and research reports are presented in concise and highly readable form. Included are articles from foreign publications, including those of the Soviet Union and its satellites.

To provide maximum coverage of metalcutting, ASTME has confined its study of metalcutting almost entirely to chip-producing machining operations, omitting such processes as shearing, oxygen cutting and chemical milling. It has, however, included some of the relatively new processes such as friction sawing, ultrasonic and electrical-discharge machining.

In compiling the bibliography, ASTME has divided machining processes into 15 conventional categories, subclassifying each of these into three general groupings—theory, experimental tests and shop practice. References included in theory and experimental-test subclassifications lead the user to all important papers published on that subject. As an example, Abstract 612, based on SAE preprint 706 and treating the effects of coolant on tool life, lists 25 references to other works on this subject as a supplement. Abstract 2458, which treats cutting-tool standardization, lists no less than 275 other references dealing with this topic.

This extensive use of references makes the bibliography valuable not only as a compendium of metalcutting information, but as a research tool as well. By identifying all useful sources of the information, it eliminates the laborious and time-consuming task of locating articles pertinent to machining.

THE EVOLUTION OF MAN'S CAPACITY FOR CULTURE—*by J. N. Spuhler. Published by Wayne State University Press, Detroit 2, Mich. Price $3.50. 85 pages.*

How old is the tool engineer's profession? In an essay in this book, S. L. Washburn speculates that "our hand is the result of at least ½ a million years of tool use." He bases this speculation on the supposition that if an early australopithecine (tool engineer) with an ape-like hand had started to use tools, selection would have changed its descendants. This anthropologist feels that all of mankind has been profoundly affected by early tool use. The implications of this speculation are, for tool engineers, profound and far-reaching. Does tool handling and tool engineering exert similar pressures today?

MANUAL ON THROW-AWAY TOOLING—*Published by the Office of Technical Services, United States Dept. of Commerce. Price $2.25. 89 pages.*

Written in the form of a technical report, this manual describes the benefits which can be derived from a program which replaces brazed carbide cutting tools with throwaway inserts. In addition, tool construction, geometry, throwaway standards, applications and estimates of conversion costs are outlined.

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has a faster, more rugged
AIR MOTOR



Truly a convenience package, the Hannifin Air Motor combines a rugged, low-friction, double-acting air cylinder with a solenoid valve. Ample air passages permit rapid cycling. Built-in speed controls make it possible to slow either or both strokes. Mounting dimensions interchange with most existing applications. "Off shelf" delivery in "standard" strokes. Bulletin 215—free on request—describes this new product.

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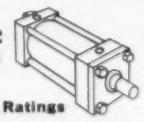


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POWER — clean, dry, drip-free power at the business end of a Hannifin piston rod is the result of Hannifin extra quality, and at no extra cost. Bores are honed to 15 RMS or finer... piston rods are case hardened, plated and polished to 10 RMS or better. Cartridge gland, removable without dismantling cylinder, has exclusive Hannifin-developed "Lipseal®-Wiperseal" combination for a truly drip-free rod.

Modern straight thread leak-proof ports for easily positioned fittings are available at no extra cost on hydraulic cylinders.

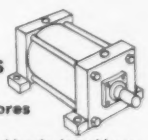
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2000 psi (3000 psi non shock), the famous heavy duty Hannifin Series "H" in 1½" to 12" bore.
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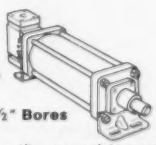
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Series "A"—steel heads, honed brass body for corrosion resistance. Hardened and hard chrome plated piston rod. For all heavy duty air service. Easily modified for water service. Full compliance JIC Pneumatic Specs.

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New from Hannifin, a complete power package combining cylinder and solenoid valve. Only one air line connection. Four mounting styles. Interchangeable mounting dimensions for most applications.



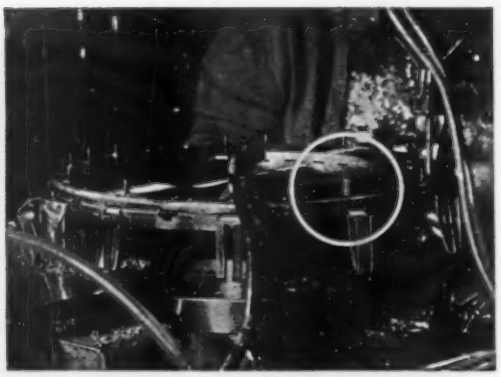
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Practical Tooling Tips

No. 3 of a series

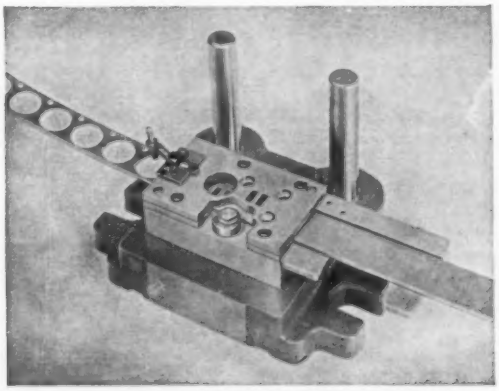
Are your tool makers wasting time making complicated tooling gadgets when a standard, off-the-shelf Vlier part could do the job much better? Why not examine your present drawings and see where these simple, low-cost parts can be used. You will be amazed at the savings possible.



PRODUCTION INCREASED 300% when this 12-station automatic indexing and tapping fixture was put to work. Vlier Spring Plungers allow the operator to load by simply pushing the part into a slot. These simple, spring-loaded tools also position the part for the tapping operation. Available in four models; fifty sizes.



NEW SWIVEL PAD-TORQUE THUMB SCREW combines the Vlier Torque Thumb Screw and Swivel Pad Clamp. The result is a perfect holding tool—one that applies only the right amount of holding pressure without damaging the finished surface. Unique ball joint construction of the pad permits adjustment to off-angle surfaces.



PROPER STOCK ALIGNMENT IN PROGRESSIVE DIES becomes a simple task with the new Vlier Stock Pusher. Saves pilots. Mounts in tapped hole. Accommodates stock as thin as .010"; width variations totalling 1/16". Nothing to wear out or foul up.



NEW 1960 CATALOG NOW AVAILABLE—Eight pages; completely revised. Includes information and specifications on all new Vlier products, including the Torque Handle, Stock Pusher, Leveling Pad. Makes ordering easy. Suggests new uses for these proven time-savers. Write for your copy today!

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Trade Literature

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NEW STANDARDS and specifications covering the Department of Defense engineering data microreproduction system are discussed. Minnesota Mining and manufacturing Co. **(Circle 401)** . . . A folder covers the use of scale models in plant design, layout and construction, and for improving manufacturing methods, processes and material flows. Knight Models, Inc. **(Circle 402)** . . . Products for the control and measurement of machinery vibration, shock and noise are described. The Korfund Co. Inc. **(Circle 403)** . . . A complete line of light-heavyweight machine tools and accessories, is illustrated. The industrial tools include drill presses, grinders, cutoff machines, band saws, and belt and disk surfacers. Walker-Turner Div., Rockwell Manufacturing Co. **(Circle 404)** . . . Developments in basic machines and accessories for precision boring and milling operations are itemized in a publication that also covers tool grinders and tooling systems for use in boring, turning, facing and multiple cuts. DeVlieg Machine Co. **(Circle 405)**

Automation and Mechanization

The Hoppermatic parts feeder handles small parts at the rate of 200,000 per hour and can be quickly changed over from one part design to another. Count-O-Matic Div., U. S. Engineering Co. **(Circle 406)** . . . Information on semi-automatic conveyors for handling large forgings and castings. Hanson-Van Winkle-Munning Co. **(Circle 407)**

Boring, Drilling, Tapping

Detailed instructions on the use of adjustable boring and reaming tools. Muskegon Tool Industries, Inc. **(Circle 408)** . . . A "leadscrew" tapper makes it possible to tap all sizes with one leadscrew. Thriftmaster Products Corp. **(Circle 409)** . . . Descriptions of a wide variety of drill bushings, including thin-wall and ASA types. American Drill Bushing Co. **(Circle 410)** . . . Special drills, reamers and cutters of high-speed steel, carbide-tipped and solid carbide types are described. Special Drill & Reamer Corp. **(Circle 411)**

Broaching

A line of continuous horizontal surface broaching and vertical surface broaching machines is described and applications where broaching produces parts more economically or faster than other methods are illustrated. The Foote-Burt Co. **(Circle 412)**

Building-Block Machines

Custom machines for contour and conventional grinding, boring and turning are illustrated, as is the use of building-block construction for many types of vertical machines. Frauenthal Div., The Kaydon Engineering Corp. **(Circle 413)** . . . Description of a variety of feed tables and machine beds. Master Manufacturing Co., Inc. **(Circle 414)** . . . Information on machining heads for milling, boring and drilling. Master Manufacturing Co., Inc. **(Circle 415)**

Chucks

Bulletin covers power and manually operated two-jaw indexing chucks that enable users to perform multiple machining operations on complex-shaped workpieces such as valve bodies and bottle molds in one chucking operation. The Cushman Chuck Co. **(Circle 416)**

Cleaning and Plating

Nine bulletins describe plating barrels and accessory equipment, including portable barrels, standard and special barrels, hanger-mounted motor drive equipment, cylinder materials and construction, tank and drive equipment, and tank transfer equipment. Hanson-Van Winkle-Munning Co. **(Circle 417)** . . . The relative efficiency of different methods of industrial batch cleaning is discussed and ways to improve efficiency are described. Parts of all sizes are covered. Magnus Chemical Co. **(Circle 418)**

Cutting Tools

A complete line of tungsten carbide tools, tool tips, dies, wear parts and indexing tools is described. Adamas Carbide Corp. **(Cicle 419)** . . . Additions to a line of standard form tools and blanks for automatic screw machines include new solid carbide cutoff tools and T-5 high-cobalt steel straight-blade cutoff tools. Somma Tool Co. **(Circle 420)** . . . Quick-change holders and adapters for boring, milling and drilling; carbide cutoff tools; milling cutters; and other tools make up a complete line. Portage Double Quick, Inc. **(Circle 421)**

Fasteners and Fastening

Rapid identification of more than 160 standard aerospace fasteners—by configuration, specification number and generic name—is provided in a reference booklet. Aircraft & Missile Div., Standard Pressed Steel Co. **(Circle 422)** . . . Multiple spindles for production nut setting are available to meet torque requirements to over 200 ft-lb. Gardner-Denver Co. **(Circle 423)** . . . Revised manual covers torque wrenches and torque wrench applications. P. A. Sturtevant Co. **(Circle 424)**

Finishing and Grinding

Improved cutting techniques utilizing a controlled, high-speed stream of abrasive particles and propellant gases are discussed. The method is used to cut or abrade hard, brittle materials, such as germanium, silicon, mica, glass, fragile crystals and ceramics. The S. S. White Industrial Div. **(Circle 425)** . . . Metal-bonded, diamond-impregnated products—drills, wheels, blades, dressers, hones, laps—are covered in a catalog. Fish-Schurman Corp. **(Circle 426)** . . . Detailed descriptions of oscillating belt grinders, 12-inch through 48-inch sizes, are given in a brochure that covers specifications and typical applications. Sales Service Mfg. Co. **(Circle 427)** . . . Information for use as a general guide in selecting the proper media for both wet and dry tumbling operations. Tumb-L-Matic, Inc. **(Circle 428)** . . . A booklet on grinding and lapping with abrasive compounds covers basic processes and finishing materials. Clover Manufacturing Co. **(Circle 429)** . . . Internal, external and straight-line honing methods and equipment are described. Recom-

mended spindle speeds and coolants for various honing operations are listed. Barnes Drill Co. **(Circle 430)**

Fluid Power

A complete line of hydraulic products for the industrial, marine and ordnance fields is presented in a 74-page catalog that covers power packages, servo valves and systems, vane pumps, piston pumps, controls, motors and drives. Vickers Inc., Div. of Sperry Rand Corp. **(Circle 431)** . . . Hydraulic components for machine tools and general industrial applications are covered in an illustrated catalog that gives data on rotary and piston pumps, control valves, complete fluid power units, hydraulic tests stands, presses and related equipment. John S. Barnes Corp. **(Circle 432)** . . . Engineers and designers can quickly determine what size hydraulic or pneumatic cylinders are required to perform given work functions, through the aid of a cylinder force calculation chart. The chart is designed for wall hanging and utilizes a movable plastic straightedge. Sheffer Corp. **(Circle 433)**

Gearmaking

A new rotary gear shaving machine is described and illustrated. Operating principles, specifications and capacity tables are included. National Broach & Machine Co. **(Circle 434)**

Instrumentation

The production rate of key automatic machines can be analyzed by using a new production rate recorder that plots by strip chart a complete log of information for any machine. It automatically integrates production data, comparing actual rate with a predetermined reference rate. Deviations from standard are shown in percentage on the chart. Details are given in a brochure. R. B. Annis Co. **(Circle 435)** . . . From 5 to 20 "on-off" production operations can be recorded on a time-calibrated, rectilinear chart produced by a new operation (event) recorder, described in a brochure. The Esterline-Angus Co. **(Circle 436)**

Lubrication, Cooling

A bulletin entitled: "The A. B. C. of Modern Lubrication" describes and illustrates lubricators, distribution systems and metering units for machine tools. Bijur Lubricating Corp. **(Circle 437)** . . . Discussion of a new air-drying solid-film lubricant. The lubricant is suitable for most types of metal surfaces and is applied by spraying, dipping or brushing. Hohman Plating & Mfg., Inc. **(Circle 438)** . . . Designed for settling out large particles from mineral oil or water-soluble coolants where ultrafine filtration is not essential, a new conveyorized settling system is explained. Olson Filtration Engineers. **(Circle 439)** . . . Magnetic separators intended for use with grinders, honing machine, gear shavers, broaching machines, thread rolling machines, milling machines and deep-hole drills are described. Barnes Drill Co. **(Circle 440)**

Materials

The current issue of the publication: *Advanced Materials Technology* discusses a number of the newer materials —special silicon carbides, boron nitride, boron carbide, fused refractories, fused magnesium, zirconium, hafnium, hot-pressed alumina and others. The Carborundum Co. **(Circle 441)** . . . A data sheet gives information on the physical and mechanical properties of new cobalt-base and nickel-base superalloys. Fabrication data is included. Cobalt Information Center, Battelle Memorial Institute. **(Circle 442)** . . . Chemical composition, physical properties and applications of nine high-strength bronzes are surveyed. Ampco Metal, Inc. **(Circle**



He's Watching a Band Sawing Miracle

This band saw operator at the Bell & Gossett Company plant in Morton Grove, Illinois, is watching "Controlled Accuracy". . . accuracy, being held to within a few thousands of being perfectly straight, and he can actually *see* the band blade being guided in the saw cut to produce this accuracy! No further machining is required before the pipe is welded into an assembly for a Bell & Gossett Heat Exchanger Unit.

Band sawing accuracy like this is nothing short of miraculous—especially when it can be done on a high production basis, as Bell & Gossett is doing. And when the same tolerances can be held on cut-off pieces from 2" to 18" in diameter, this MARVEL #81 Band Saw Machine can be truly called a precision machine tool.

The secret of this amazing sawing accuracy is in the MARVEL "SURE-LINE" Automatic Accuracy Control—a simple and extremely effective electro-mechanical servo-mechanism that continuously senses and automatically corrects any tendency of a band blade to drift to either side of a desired line of cut. The "SURE-LINE" unit literally "steers" the blade to make a straight cut. This permits the use of heavier feed pressures and, when desirable, higher blade speeds, to do the work faster, without sacrifice of accuracy. Incorporated in the new MARVEL #81 Series High Speed Heavy Duty Hydraulic Band Saws, the "SURE-LINE" permits full utilization of all the advantages of high speed steel band saw blades—while extending their usable blade life as much as 50%.

Before you buy any band saw machine, get complete details on MARVEL #81 Series Single Cut, or Automatic Shuttle Type Bar Feed Production Band Saws—the machines DESIGNED AND BUILT TO REDUCE SAWING COSTS. *Write for catalog today.*

ARMSTRONG BLUM MANUFACTURING CO.
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Metal Cutting MARVEL SAWS

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Trade Literature

443) . . . Flash curing of foundry molds and cores with carbon dioxide eliminates baking and drying and gives better accuracy, according to a brochure. Pure Carbonic Co., Div. Air Reduction Co. Inc. **(Circle 444)** . . . Wear caused by abrasion, corrosion, erosion and high temperatures can be minimized by a new line of hard-facing powders, known as "spray fuse powders." Deloro Stellite Div., Deloro Smelting & Refining Co. Ltd. **(Circle 445)** . . . A new heavy-duty grade of carbide, NTA, gives improved results for general-purpose applications according to performance data given in a bulletin. Firth Sterling Inc. **(Circle 446)**

Motors, Drives

Four new synchronous motors, rated at 50, 150 and 250 oz-in. all have a basic shaft speed of 72 rpm and can be used as constant speed a-c motors or as d-c stepping or incremental positioning devices. The Superior Electric Co. **(Circle 447)** . . . New ¼ to 25-hp mechanical adjustable-speed drives are covered in a bulletin that discusses principles of operation and the selection of drive units. General Electric Co. **(Circle 448)** . . . A booklet: "Parallel Shaft Speed Reducers" describes reducers in 57 sizes. Link-Belt Co. **(Circle 449)** . . . Applications for electromagnetic drives are illustrated in a booklet that shows how electromagnetic drives work and where they are used. Westinghouse Electric Corp. **(Circle 450)** . . . Information on direct-current adjustable-voltage drive equipment for planers. General Electric Co. **(Circle 451)**

Pressworking, Dies

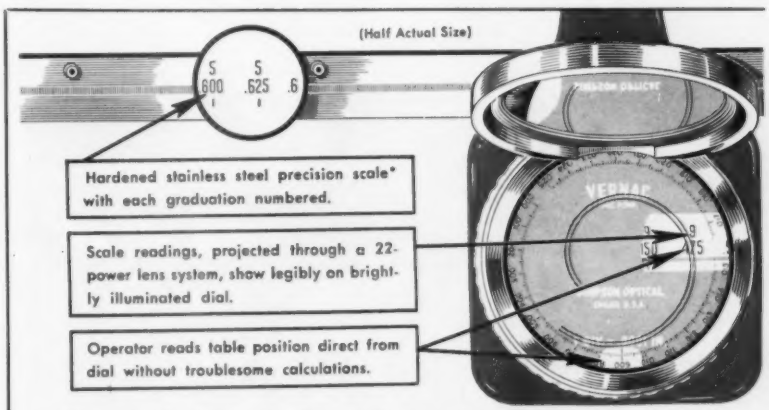
A new die assembler is mounted on ball-bearing casters for easy wheeling to any location in pressroom or toolroom. The Producto Machine Co. **(Circle 452)** . . . Mounting accessories for hole punching and notching units plus other accessories for setting up units in presses and press brakes. Punch Products Corp. **(Circle 453)** . . . Descriptions of presses in a new line of welded-steel inclinable power presses. The Cleveland Punch & Shear Works Co. **(Circle 454)** . . . A multipurpose, single-station sheet metal-working machine with large throat depth is designed with swing-shift punch holders and drop-in die buttons that allow tools to be changed in as little as 20 seconds. Wales Strippit Inc., Div. Houdaille Industries, Inc. **(Circle 455)** . . . Containing a selector chart, a catalog lists a line of perforating units for mild steel up to ⅛ inch thick. Tool Products Corp. **(Circle 456)** . . . A complete line of transfer presses is described in a booklet that covers typical applications. The Baird Machine Co. **(Circle 457)**

Swaging, Cold Forming

Swaging machines, feeding accessories and related equipment. Engineering data on applications is given. The Fenn Manufacturing Co. **(Circle 458)** . . . The Roto-Flo process for cold-forming splines, serrations, grooves, threads and similar forms is described and illustrated. Ways to obtain increased output and better tool life are highlighted. Michigan Tool Co. **(Circle 459)**

Threading

A complete line of self-opening threading and hollow milling heads, collapsible and solid adjustable taps, and a new line of five-chaser heads for revolving and nonrevolving spindles. The National Acme Co. **(Circle 460)** . . . Capable of measuring the pitch diameter of internal threads to an accuracy of 0.0002 inch, a new type of thread gage is available. The extent of error is directly readable. Wear can be compensated for. Details are in a brochure. Homestrand Machine Tool Co. **(Circle 461)** *(Continued on next page.)*



New optical measuring instrument assures . . .

high operating accuracy for new or used machine tools

The new VERNAC Direct Reading Optical Measuring Instrument eliminates the complexities of using end rods and gage blocks. Now, the longitudinal, lateral or vertical positioning of machine tool tables can be quickly and easily read direct to .0002". Accuracy is not affected by the wear or stretch of table movement screws. The instrument itself has no moving parts which can impair accuracy.

VERNAC instruments also up-grade machine tools to perform tasks beyond their original accuracy. For example, they can up-grade moderately priced milling machines to the accuracy of more expensive jig boring machines at a fraction of the latter's cost.

*The scale is a replica of a master certified by the U.S. National Bureau of Standards to .0001" maximum error over its entire length.

SEND FOR FREE BULLETIN. Explains how the VERNAC enables you to do more precise work on your present machine tools.



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Turning

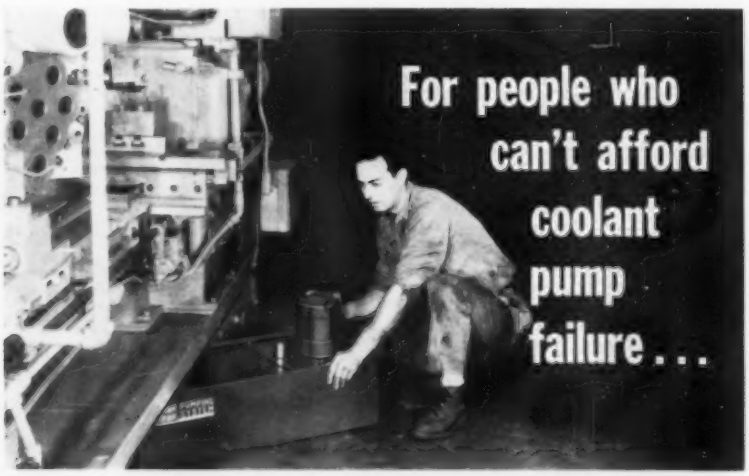
A completely new and fully automatic turret lathe and a redesigned automatic chucking turret lathe, as well as other lathes and attachments, are covered in the 12-page booklet: "Gisholt Machines." Gisholt Machine Co. **(Circle 462)** . . . Several new models of pilot lathes are described in an illustrated brochure. Cone Automatic Machine Co. Inc. **(Circle 463)** . . . A single lever starts the lathe spindle, selects any speed up to 4800 rpm, changes speed during operation, or instantly stops or reverses the spindle of a new speed lathe. Rivett Lathe & Grinder, Inc. **(Circle 464)** . . . Some 39 bar machine and 18 chucking machine applications are described in a bulletin that uses a case-history approach to show tooling practices. The National Acme Co. **(Circle 465)**

Welding

Equipment and procedures for spot-welding hardenable steels are charted. The Taylor Winfield Corp. **(Circle 466)** . . . Utilizing epoxy impregnation and encapsulation, a line of resistance welding transformers provide up to 33 percent more KVA capacity due to the higher permissible heat rise. Kirkhof Manufacturing Corp. **(Circle 467)** . . .

FOR MORE INFORMATION . . . Just circle the appropriate number on the postpaid Readers Service Card, page 187.

A pocket slide chart facilitates the selection of the proper electrodes for joining many ferrous and nonferrous alloys. Ampco Metal, Inc. **(Circle 468)** . . . Pocket size, a 56-page welding, brazing and soldering alloy and flux catalog is combined with an intruction manual. All-State Welding Alloys Co., Inc. **(Circle 469)** . . . A self-study silver brazing course for in-plant or at-home training is described. Handy & Harman. **(Circle 470)** . . . Welding information is condensed in a 23 by 45-inch electrode wall chart. Hobart Brothers Co. **(Circle 471)** . . . Containing tables that simplify calculation of the power supply required by resistance welders, a brochure makes it easy to establish maximum safe rates of operation. The Taylor Winfield Corp. **(Circle 472)**



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SUPERFLO COOLANT PUMPS and
PUMPING SYSTEMS

GRAYMILLS Coolant Pump and Tank Units can be installed in a matter of minutes. You'll keep production rolling and get smooth, steady performance at *less cost*. These GRAYMILLS Pumping Systems are especially convenient to use with older machines, such as low bed turret lathes. Designed to fit under the bed, they offer 3 big advantages over the older built-in pump and sump units:

- 1. Larger capacity to dissipate heat. Remember, overheated coolants cut tool life.
- 2. It's easy to service a Graymills pump and tank unit. Just slip it out and clean. No more struggling with inaccessible shallow pumps.
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Available with 1/25 to 2 HP pumps, tank capacities—2 to 38 gal. You can install 'em, then relax and forget 'em. Sold by leading industrial distributors everywhere.

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WHERE TO GET IT . . .

in the 1960 Suppliers Directory in the June 15 issue . . . which lists 1400 products, nearly 2300 manufacturers and 20,000 local suppliers.

technical shorts

New Process Colors Titanium

A new process for coloring titanium has been developed by Hi-Shear Corp., Torrance, Calif. Used to apply uniform colors without the use of dyes and paints the process is also used to apply milticolors to a single workpiece.

Advantages of the process are two-fold: it provides color-fastness at temperatures to 600 F and it greatly increases titanium's resistance to corrosion. When applied to titanium nuts and bolts, it alleviates the galling normally encountered in male and female thread combinations.

Other applications for colored titanium are found in the color coding of high temperature components including parts for nuclear reactors. No changes in basic physical properties result from use of the color process.

Improved Fatigue Properties In Steel

Recent investigations conducted by the National Bureau of Standards have shown that steels containing copper as an alloying element demonstrate superior fatigue properties when heat treated to high-tensile strength. The amount of copper in the alloy appears to be critical with 1.3 percent by weight providing optimum strength when low tempering temperatures are employed. These results, obtained in a study of both commercial and experimental steels, may have practical applications in production of fatigue-resistant steels.

Inexpensive Numerical-Control System

A numerical-control system which operates without electronic components has been developed by Moog Servocontrols, Inc., East Aurora, N. Y. Electronic controls have been superseded by pneumatic and hydraulic positioning devices.

Actuated by means of a punched tape input—or by dial console or manually if desired—the system converts pneumatic pressures into oil power which operates pistons for precision table position. Applicable for most types of point-to-point machine tools, the system has a guaranteed repeatability of ±0.0003 inch and positioning tolerance of ±0.0005 inch.

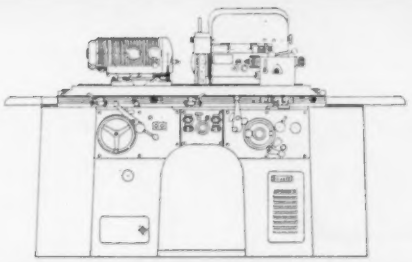
Hydrostatic Pressure Cold-works Rifle Barrels

Increased fire power and lighter weight in artillery has been made possible by a new process called "autofrettage," Basically, the process consists of cold - working a gun tube's interior surface by subjecting it to extremely high hydrostatic pressure. The pressure is built up in a mixture of water and glycerin which expands and strengthens the gun tube by cold working its interior.

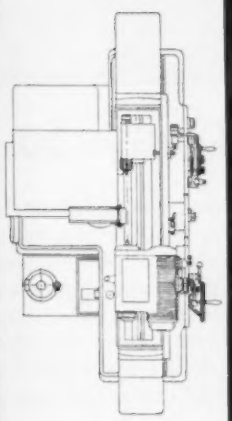
The principle of autofrettage was evolved at the turn of the century, although no concerted effort at applying it to production of ordnance was made until the early 1940's. As applied at Watervliet Arsenal during World War II, it successfully cold worked 90 mm gun tubes to yield strengths of 80,000 psi. The present cold-working program initiated at Watervliet Arsenal in 1956 is able to provide yield strengths of 200,000 psi. Normal working pressures in the autofrettage process is 175,000 psi.

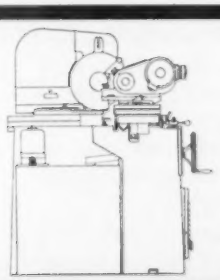
Application of this development to production of artillery is one of the comparatively new techniques which are modernizing the manufacture of ordnance. Another of these techniques—geared rifling—is discussed in an article by Messrs. Goerold and Ropitzky on page 107 of this issue.

olivetti



One piece or ten thousand, the Olivetti R4 cylindrical *grinds precisely the diameter set on the handwheel. The easily engaged positive stop guarantees final size on plunge or traverse feed. Machines are accurate to fifty millionths or better wheelhead repeatability. Dependability of the stop minimizes the necessity for expensive gauges; and high production, automatic wheel dressing with wheel wear compensation as well as rough-finish-dwell cycles conveniently automate any of the Olivetti models.* ■ *Also, investigate R4 series "E" gaugemaker's grinders for tolerances within several millionths—to be installed only where temperature and other factors are carefully controlled.* ■ *Universal and plain. Swings from 10" to 18"; up to 84" between centers.*





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There are now four free-cutting, high-conductivity Anaconda coppers that broaden the combinations of mechanical, physical, and fabricating properties available for boosting production and cutting costs of high-conductivity parts. They are furnished chiefly in rod and bar, but are available also as extruded shapes and, except for the leaded coppers, die-pressed forgings of simple design. All have good cold-working properties.

Leaded Copper-126 and Deoxidized Leaded Copper-129 have slightly higher electrical conductivity—98% IACS annealed, 95% IACS, minimum. The difference between them is that Alloy 129, being deoxidized, is not subject to hydrogen embrittlement when annealed or furnace-brazed in reducing atmospheres. Neither leaded alloy is recommended for hot working.

Tellurium Copper-127 and OFHC* Sulfur Copper have an electrical conductivity rating of 95% IACS annealed, 90% minimum. Both may be extensively hot worked and neither is subject to hydrogen embrittlement. Tellurium Copper-127 has the advantage of retaining its mechanical properties at temperatures higher than those tolerated by the other free-cutting coppers—and hence is widely used in the welding and cutting-tip field.

The free-cutting coppers may be machined at cutting speeds approaching those used for machining Free-Cutting Brass. For Tellurium Copper-127, however, carbide-tipped tools are recommended as the inherent copper telluride particles cause somewhat greater tool wear. *Registered Trademark of American Metal Climax, Inc. 6047 Rev. 1.

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Tech Digests

Reliability and Design

Statisticians usually define reliability as probability. For the design engineer it is defined as an ability. To engineers, reliability is a design parameter which technically defines the ability of the design to continuously meet specified requirements. It is a property of the equipment that must be designed into the equipment by the engineers. Such requirements are sometimes expressed as mean time to failure or mean cycle to failure, implying that the device must operate for a specified period of time or cycles without exceeding the specified number of failures.

Design concepts have been modified by developments in the understanding of reliability. For example, safety margins must be used in design. The old concept of a simple numerical safety margin was somewhat static. Newer concepts of safety are dynamic, such things as variability, strength of the device, variability of conditions under which it operates, must be considered. The concept of equipment life has been extended. What might formerly have been considered good life is now insufficient to meet specifications.

Out of experience in reliability it has been found that the problem is best defined as a systems parameter or systems problem. It is virtually impossible to consider reliability of a subsystem without considering reliability of the entire system. The system reliability concept entails analysis of the overall system as being made up of n-independent subsystems, so that the system characteristic is given by conventional equations using the product rule for multiplying independent probabilities.

Such use of probability calculations requires modification in the light of experience in the three principle phases of life cycle failures. The first phase is a period of high initial failure or infant mortality. The second phase is the random failure rate. The third and final phase is the wearout or old-age period where the failure rate rises to a relatively high value. Also, some equipment life is a function of cycles rather than a function of time.

Reliability specifications for modern equipment, particularly weapons systems, are stringent and tax the ingenuity of design engineers. Techniques are available, such as establishing reliability proportionment, determining variations of environment and strength, including safety factors, utilizing redundancy for its known advantages, derating components in usage so as to operate far distant from their margins, avoiding complexity and overdesign, design review or utilizing knowledge and experience of other people for augmented reliability, designing test and failure experiments scientifically, and using elapsed time meters or counters.

Based on ASME paper No. 60-MD-2 by Harry R. Powell, Space Technology Lab., Los Angeles, Calif. Presented at the Design Engineering Conference and Show.

▼ ▼ ▼

Hydraulic Spindle Drives

Higher accuracies and higher horsepowers are constantly requested by machine tool users. Horsepower demand has been going up to allow the use of carbide tools and to machine various high-temperature alloys. Low friction and low inertia are necessary for accurate performance. Low weight of moving components is desirable for reduction of friction and inertia.

To meet these demands, hydraulic drive spindles are helpful in several ways. The hydraulic drive is lighter than an equivalent electric drive. The heavy components are usually mounted on the floor. For example, a 20-hp hydraulic motor weighs approximately 20 pounds, the equivalent electric motor weighs 388 pounds.

By using a variable displacement hydraulic motor, speed changes can be accomplished up to a ratio of approximately 4:1. With gearing, the range is extended. A relief valve in the system can act as a safety valve, to protect against overload. It can be set to the required pressure to protect the spindle mechanism, the cutter, etc.

As an example of the speed-range possibilities of hydraulically driven spindles, a machine was designed using a variable speed hydraulic motor operating a maximum 2200 rpm and a minimum 550 rpm. Driving through two planetary transmissions, speed is further reduced to a minimum of 44 rpm. Total range is thus from 44 to 2200 rpm.

Two choices of arrangements exist for designing such hydraulic drives. First, a constant delivery hydraulic pump can drive a variable displacement hydraulic motor. Second, a variable pump can drive a fixed displacement motor. Each arrangement has certain advantages and disadvantages. Under ordinary circumstances, it is more economical to put the variables at the spindle.

Based on a paper by B. Welte, Technical Director, Colonial-Romulus Div., Colonial Broach & Machine Co., presented at the Fourth Production Machine Tool Hydraulic Conference, Detroit, Mich.

▼ ▼ ▼

Productivity Improvement

Productivity can be defined as the ratio of physical output of goods and services to the total input of capital and human effort and is required to combat the effects of inflation and foreign competition. This is especially urgent as the increased costs of machinery, material and labor tend to cause price increases that shrink sales.

Successful management has overcome some of these effects and certain techniques are common in the successful efforts. The integrated market, product design and manufacturing team is used, with adequate research and development to back them up. Manufacturing has evolved from a versatile line organization to an organization of specialists for planning and controlling. Controlling capital input, the first factor in the

denominator of the productivity ratio is critical. Two basic approaches are used at Westinghouse to help the fixed asset program: (1) to prevent overbuilding, it is recognized that methods changes will produce a minimum of 3 percent increase in production. (2) Production equipment acquisitions must be more productive than those units they are replacing. Also helpful are three-dimensional layouts for more efficient use of the cube of the plant, and cheaper, but adequate techniques for accomplishing a job.

The human effort factor, second part of the denominator, has been rendered more critical by increased fringe benefits. Productivity of an operator normally increases with learning and skill, till a level is attained. From this level, the only productivity improvements available are those that derive from injecting methods changes into the basic operator performance, by work station improvements, and by motion economy principles to eliminate unproductive effort. Mechanization is helpful, but should be used cautiously as overmechanization can increase costs, particularly when product change can cause obsolescence.

Output, numerator of the definition, can be increased by mechanization, but usually requires volume to pay off the cost of planning, design and debugging. The areas of fabrication and material handling particularly can be improved by joint project analysis, with the sales, product design and manufacturing team. Where volume is not available as a justification for mechanization, numerical control has provided an important breakthrough, and it has been forecast that within ten years, 50 percent of the new mechine tools produced will be numerically controlled. As an example of possibilities, a concept of the future plant was set up and demonstrated at a recent company meeting. As visitors arrived, they were given an order blank for an aluminum block engraved with their initials. A secretary typed it on a tape punch typewriter, and this information, after computing and translating, served for machining the initials on the aluminum stock. With two loading stations at the machine, one part was always in production while the other station was being loaded or unloaded. For a finishing operation, parts were hung on a chain, heated, dipped in plastic, and delivered to the visitor with the punched tape 15 minutes after the order had been placed. What was demonstrated basically was the productivity of an integrated plant of the future.

Based on a paper by R. E. Fromson, Westinghouse Electric Corp., presented at the Cleveland Engineering and Scientific Center, 3100 Chester Ave., Cleveland 14, Ohio.

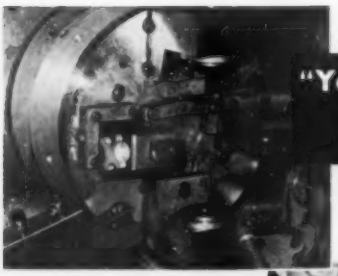
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Preventive Maintenance

A good workable preventive maintenance system is like a raise in pay, very desirable and hard to obtain. Cooperation of top management is essential. The human element pays an important part in the procedure. Good preventive maintenance starts with good design. JIC standards have made for better hydraulics, more accessable machines and equipment and in general better designs.

As successful preventive maintenance requires full cooperation of top management, production supervision and service departments, records are essential. They spotlight trouble spots. The machine record card system has been effective. It contains information used when new equipment is purchased or when existing equipment is retooled.

Orbit Valve, Tulsa, proves it again:

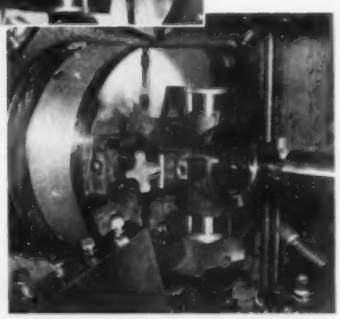


"You make money every time you chuck with *Buck*"



Shows clever, equalizing fixtures and top jaws developed by Orbit which work in conjunction with the 2 jaws of the Buck power chuck.

Operator places valve in position for machining. Lathe is a 3 AC Warner & Swasey Automatic.



Final operating step: finish reaming. Four other operations include — rough face of valve body flange, rough drill, and rough bore; rough drill trunnion diameter, rough out bonnet diameter; cut core clearance, finish bonnet diameter; finish trunnion diameter and bottom of trunnion. Trunnion tolerances and concentricity must be within .003".

The continual plant modernization program of Orbit Valve Co., Tulsa, Oklahoma — pioneer producer of valves for handling petroleum and petrochemicals — resulted recently in saving 18 hours a week on valve body production.

The major change was from hand turret lathe operation to automatics, using the Buck Aluminum body power chuck. It could be done because of the Buck precision capabilities.

Future expected improvements are a 10% increase in production, major time-savings on a former true-up operation, and consistent quality that will reduce inspection time.

The Buck Ajust-Tru® principle guarantees precision within .001" on automatics, and provides many other distinct advantages. Send for a catalog. See why "It pays to chuck with Buck."

Makers of Scroll, Power, Dust Proof, Independent Chucks.

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Its primary purpose is for preventive maintenance. The forms and procedures are described and illustrated in detail. Also described is a "red tag" procedure for oil leakers. Through the use of the red tag system, considerable savings in oil has resulted.

A well-supervised third shift is necessary for a workable preventive maintenance system when a shop is running to capacity. The best available men and supervisors are used. But unless the supervisor is provided with proper materials to make a good lasting repair, the preventive maintenance program is not successful. The machine records provide the information needed to select materials for the repair, which is especially helpful when such information is not given on prints or in service manuals. Finally, job procedures and warnings, both for safety and good maintenance, are listed.

TO REQUEST COMPLETE PAPERS WRITE TO THE ADDRESS AND ORGANIZATION INDICATED AT THE END OF EACH ABSTRACT

Based on a paper by F. E. Fiedler, Division Superintendent, Machine Tool & Die Div., Chevrolet-Buffalo Div., General Motors Corp., presented at the Fourth Production Machine Tool Hydraulic Conference, Detroit, Mich.

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Radioisotope Study of Tool Wear

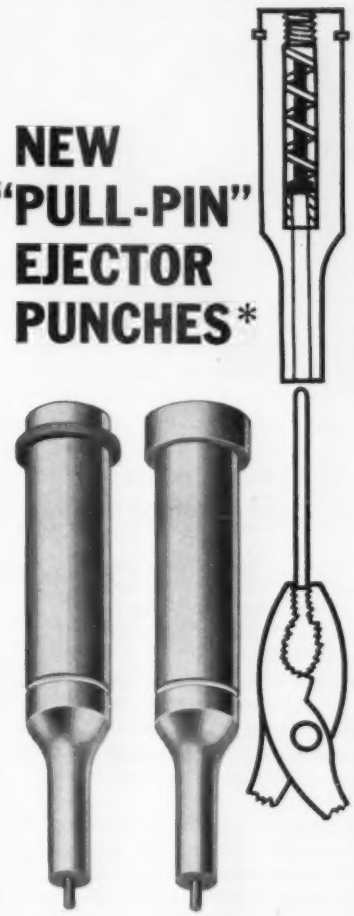
As tool wear is part of the cost of metalcutting, considerable study has been made of the phenomena of tool wear to reduce machining costs. The usual method of optical measurement of tool life end point or flank wear land criteria varies by as much as plus or minus 30 percent. Determination of tool wear by measuring volume or weight changes of a cutting tool is also uncertain due to buildup.

The method of radioactive tool wear measurement is accurate, rapid and offers a technique for investigating the actual mechanism of tool wear. Essentially in this method the amount of tool material worn from a cutting tool is irradiated. The activity of wear transmits radioisotopes to the chips. The quantitative measure of tool wear can then be obtained, since the amount of radioactivity present in the chips is directly proportional to the quantity of metal worn from the tool during cutting. Wear products of the magnitude of 10-10 grams can be easily determined.

The choice of radioisotope used depends on tool material, half life of the isotope, method used to detect radioactivity and the specific activity of the tool. Several precautions are taken for scientifically valid testing of tool wear, such as correcting wear rate data by measuring the amount of wear products in cutting fluid.

There are many cases showing the advantages of this method. In determining the relative machinability of an experimental high silicon content aluminum alloy, the radioactive method required five days and 20 lb of metal. By conventional flank wear measurement methods, at least six weeks would have been required and vast amounts of metal as well. Quantitative information on the effects of rigidity has not been available. However, by using two toolholders of widely different rigidity characteristics, results were obtained using the radioactive method. Wear resistance characteristics of a number of grades of carbide cutting tools have

NEW "PULL-PIN" EJECTOR PUNCHES*



CUT GRINDING TIME 90%

With no special tools—*just pliers*—you can pull ejector pins from punches *in seconds!* Pull-Pin Ejector Punches eliminate the costly procedure of disassembly of punches or removal of stripper plates.

Just pull the pin, depress the stripper, sharpen the punches, push the pin back in. Even closely grouped punches are prepared for grinding instantly.



NEW CATALOG shows round and shaped punches and dies. Information is provided on engineering specifications, material and heat-treating, punch and die clearances, blanking pressures, etc. Ask your distributor, or write direct.

*PAT. PEND.



New line includes Regular, Medium and Long lengths in Ring and head-type punches; complete range of press-fit and head-type stripper bushings; quill punches in 3 sizes.

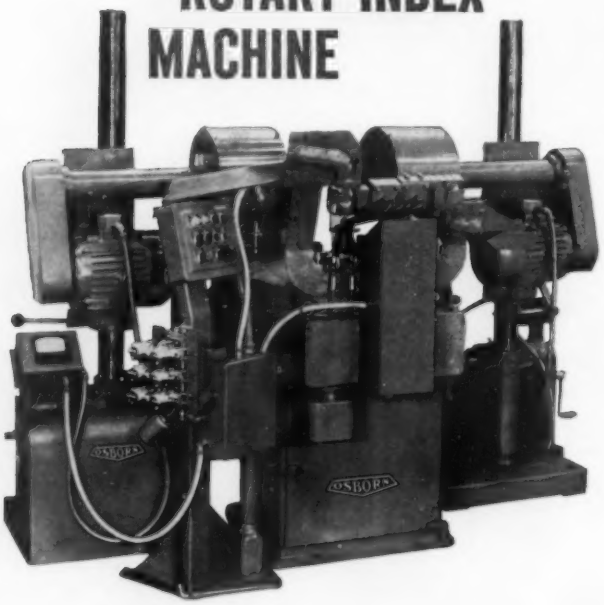
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OSBORN AUTOMATIC ROTARY INDEX MACHINE



features "building block" components arranged for completely automatic finishing cycles

An automatic part load/unload and turnover mechanism is the latest addition to Osborn's Rotary Index metal finishing units. This feature eliminates the need for production machine operators—and means regulated work flow plus higher production rates.

Most significant feature is the use of a *standard* index table and *standard* finishing heads easily tailored for efficient, economical *automated finishing* operations.

Other advanced design and construction features make these Osborn Metal Finishing Machines worth your immediate investigation.

Your Osborn field specialist has latest application data on a wide range of cost-saving finishing methods. An Osborn Analysis—made in your plant now at no cost or obligation—is the first step to pinpoint savings in *your* operations. Write or call *The Osborn Manufacturing Company, Dept. K-64, Cleveland 14, Ohio. Phone ENdicott 1-1900.*

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Metal Finishing Machines . . . and Finishing Methods
Power, Paint and Maintenance Brushes • Foundry Production Machinery
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similarly been determined. The method has also produced usable results in the studies of titanium, milling and various turning operations.

Special studies are possible by this means. An autoradiograph can be obtained by placing a chip cut with a radioactive tool in contact with photographic film and allowing the radiation emitted by wear particles to expose the film. The use of such techniques is shedding much information on the nature and mechanism of tool wear. For instance, on examining the chip removed by a milling cutter it is immediately apparent that a high concentration of wear particles is the result of impact as the tool enters the workpiece. A similar concentration occurs as the tool leaves the workpiece, due to a "plucking" of the tool as the built-up edge is sloughed off. This can provide guidance for improving design of cutting tools.

Use of radioisotopes in the form of irradiated cutting tools is a powerful tool for investigating tool wear. It provides a method for rapid and accurate evaluation of the wear parameter and also operating means for studying the actual mechanism of tool wear. Combined with conventional methods, it should help in solving the practical problems associated with cutting.

Based on SAE Paper 181A by Marko Pallobagis and E. J. Krabacher, Cincinnati Milling Co. Presented at the Summer Meeting of the Society of Automotive Engineers, Inc., 485 Lexington Ave., New York 17, N. Y.

▼ ▼ ▼

Numerical Control Applications

In reviewing the diversity of numerical control applications to machine tools today, it is hard to believe that the first rudimentary experiments in this new art were performed in the Lincoln Laboratories at MIT, only 9 or 10 years ago. In this very short period of time, there has grown up a highly specialized industry which now supplies a large number of differing systems to the majority of machine tool builders in North America. Technical progress has been so rapid that these control systems are already regarded as a standard accessory to a machine tool, and the "mystery" factor is fast disappearing.

Not only are machine users becoming more familiar with numerical control techniques, but more significant still, an important change of thinking has occurred in the ranks of the machine tool industry itself. Even 5 or 6 years ago, the very thought of becoming in-

volved with those notorious experimenters in the electronics industry, was enough to give the average machine builder an acute attack of paranoia. Not so today, however, most machine builders have in one way or another gotten their feet wet in designing and selling numerically controlled machinery. Some indeed have jumped in altogether and have developed their own systems in competition with established control builders, and have done so with varying degrees of success.

But the average machine builder purchases controls tailored for his particular application. He is, however, confronted with a difficult purchasing

TO REQUEST COMPLETE PAPERS WRITE TO THE ADDRESS AND ORGANIZATION INDICATED AT THE END OF EACH ABSTRACT

situation. Control systems have become highly competitive, not only economically speaking but also technologically. The machine builder is confronted with a bewildering variety of design concepts and application approaches, and has his work cut out to evaluate his proposals technically.

The power drive
- hydraulic motor
- hydraulic cylinder
- a-c electric bang bang
- d-c electric closed loop

The measuring or feedback loop
- synchro resolvers
- potentiometers
- pulse generators
- code wheels
- photoelectric data elements
- linear transducers

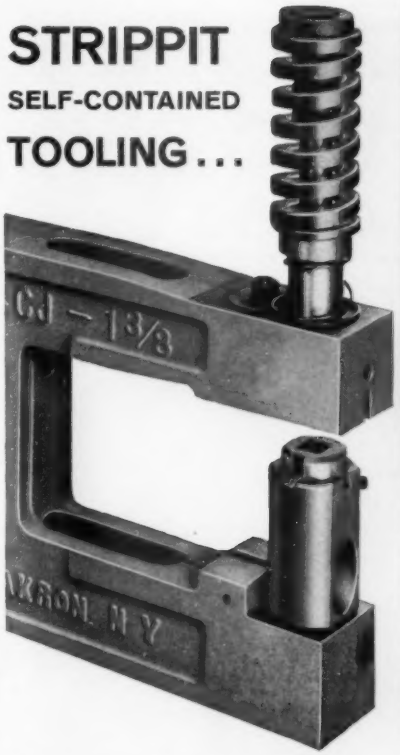
This last item again opens up a further fascinating array of ingenious devices such as:
- photoelectric diffraction gratings
- inductive linear coils
- electromagnetic E coil pickoff
- electromagnetic screws

and astounding combinations and permutations of all of the aforementioned principles.

The last main area in which systems differ widely is the input or data reduction method. Here we find:
- electromechanical sequential readers
- photoelectric sequential readers
- electromechanical block readers
- pneumatic block readers

As you can see all this represents a veritable treasure house for the imagina-

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SELF-CONTAINED
TOOLING . . .



cuts costs 10 ways



1. no expensive custom dies—save all the time and cost involved in designing and building custom, single-purpose dies.

2. lower labor costs—no high-salaried tool and die makers are needed. Any good bench man can set up Strippit Tooling.

3. minimum tool investment—Strippit units can be kept in continuous use. You have no heavy investment in idle dies—no die storage problem.

4. shorter lead time—as soon as the pattern is ok'd, Strippit Tooling can be set up and put into production *immediately*.

5. faster, more accurate setups—Strippit units are self-contained, self-stripping and permanently aligned—bench-assembled on drilled templates, T-slotted plates or bed rails. Nothing is attached to the press ram. No need for die spotting and setting.

6. press downtime cut—as each run is completed a new Strippit setup is already waiting for the press. Self-contained design permits punch replacement in the press. Downtime is kept to a minimum.

7. unlimited versatility—Strippit units can be set up in any hole pattern and used over and over again—for long press runs or quick-change pilot runs—in stamping presses or press brakes.

8. a complete line from a single source—punching units with standard or special tooling, for punching up to ¾″ mild steel—standard and special notching units for work up to ¼″ mild steel.

9. nationwide sales and service—by trained tooling methods engineers in all major industrial areas. Manufacturing plants in Akron, N.Y., Los Angeles, Calif.; warehouse in Chicago, Ill.

10. specify "Strippit"—the original system of self-contained tooling. There are imitations but no substitute for Strippit engineering know-how, tested and proved designs and materials, first-class workmanship and the other advantages of doing business with a reputable organization that has been in business for 35 years.

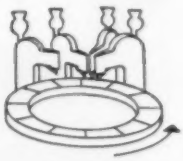
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A UNIT OF HOUDAILLE INDUSTRIES, INC.

A FEW OF MANY POSSIBLE RIVETING HEAD POSITIONS THAT CAN BE USED

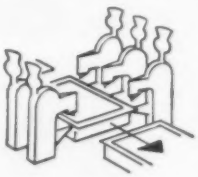
Rotating fixture showing suggested arrangement of riveting heads.



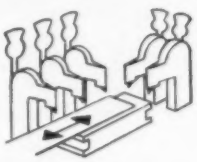
Riveting heads can be positioned for fastening on flat or curved assemblies.



Conveyor Belt permits multiple setting on both sides of an assembly.



Sliding fixture used for riveting 2 sides of an assembly.





AUTOMATE RIVET SETTING

for new low costs

For years assemblies made of metal and non-metal or a combination of both have been fastened most economically with semi-tubular rivets. And now even lower costs are possible with the thin-nose riveting heads designed by Chicago Rivet. These heads, pneumatically operated but electronically controlled, can be grouped in clusters on one or more planes and will set rivets as close as $1\frac{3}{16}$" apart. Automation, thru rotating sliding or continuous belt feeding and riveting stations, is possible. Riveting heads may be repositioned and used again on new assemblies.

CUSHIONED RIVETING REDUCES BREAKAGE

A pneumatic riveter upsets the rivet with a squeezing action which minimizes breakage and automatically compensates for slight variation in assembly thicknesses.

The suggestions of Chicago Rivet fastening specialists will prove most helpful. Call them—no obligation.



AIR-POWERED RIVETING CATALOG contains description and specifications of 8 single and multiple riveters—also rivet setters designed for automation.
RIVET CATALOG describes 1388 standard tubular and split rivets and 25 single and multiple motorized automatic rivet setters.

Chicago Rivet & MACHINE CO.

960 So. 25th Ave., Bellwood, Ill. (Chicago Suburb) • Branch Factory: Tyrone, Pa.

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tive sales engineer who wants to blind his customer with science. (To use the nicer of two apt expressions.) For all practical purposes, however, systems fall into two basic groups dictated by the way they measure physical displacement.

1. Those that convert the action of the transport mechanism (leadscrew or rack and pinion) into an electrical analog
2. Those that measure independently of the transport mechanism.

In measuring from the transport mechanism, accuracy is dependent on the transport mechanism. All the errors in the leadscrew and gearing are reflected in the data elements (feedback) geared to the transport mechanism. Second, backlash and overshoot problems are encountered. But using a measuring system independent of the transport mechanism has certain advantages. Cost of highly accurate transport mechanisms is avoided. Application to standard machine tools is easier.

In the Sperry system, feedback transducers are mounted parallel to the machine motion. A coarse data element positions to with 0.050 inch of final desired position, and the fine scale transducer controls positioning to final destination. The fine scale transducer consists of a micalex slab with a hair-pin shaped coil plated along its length. A slider rides over the scales, with a small air gap between the slider and slab. Accuracy of the device is not affected by wear because there is no physical contact between the two components.

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Measurement is carried out independently of any inaccuracy in the machine. An electrohydraulic servo valve, specifically designed for operation with hydraulic cylinders is used to drive the machine. The valve consists essentially of a spindle that rides in a bored hole with symmetrically arranged portings. A torque motor linked directly to the shaft of the spindle rotates the spindles in accordance with error signals received from the control unit. The valve has only two or three moving parts, is hydraulically self-centering and is relatively insensitive to dirt. Using hydraulic cylinders to move machine axes is an economical solution that provides high-speed positioning.

A field reader is used in the Sperry system, to avoid the need for memory storage units. The reader operates approximately at the rate of 10 frames per second.

The tape reader is roughly analogous to the player piano in that air is blown through a number of tubes to the tape. The tubes are connected to diaphrams which trip microswitches to read the signals. Standard one-inch paper tape, binary-coded decimal is used.

Application of the control unit to a DeVlieg jig mill, Burgmaster, Bullard and Moore jig borer are described. Consensus of opinion among numerical control users is that the man who needs a numerically controlled machine tool is already paying for it.

Based on a paper by H. G. Hauck, Manager Numerical Sales, Sperry Gyroscope Co. of Canada, presented at the Fouth Production Machine Tool Hydraulic Conference, Detroit, Mich.

▼ ▼ ▼

Marketable Inventions

Three classes of inventions exist: (1) a new or improved process for manufacturing an existing product; (2) a major improvement in an existing product; and (3) a completely new product. Evaluating marketability of an invention for each of these three classes requires different criteria. For an organization already making and marketing the product of the new process, evaluation is a straightforward engineering economics analysis. Product improvement inventions include the great majority of inventions. The cumulative effect of such inventions is what makes a new automobile so different from an automobile of 1912—but the improvements are not totally new. In evaluating this type of invention, two factors are involved: (1) there must be a real improvement, not just a change that may be no better; (2) the improvement must be attractive enough to potential purchasers that they will either buy more of the product or pay a higher price for it so that any additional investment required will be justified.

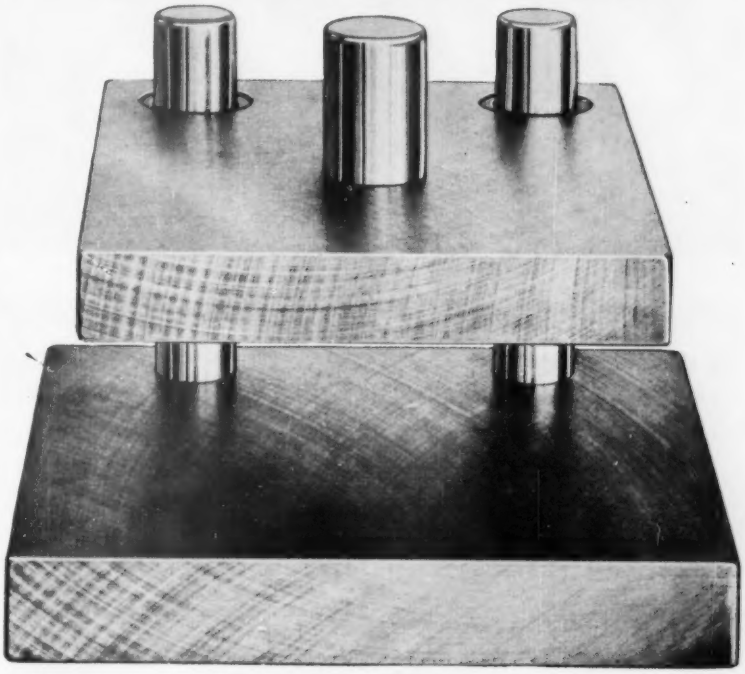
The third type of invention, a completely new product, is the most difficult to analyze and can require considerable market research for successful exploitation of the invention. Eighty-five percent of failures are due to inability to market the product. It is too often overlooked that the actual cost of commercializing an idea can be more than the cost of technically developing the idea.

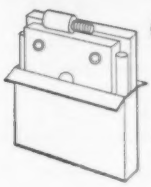
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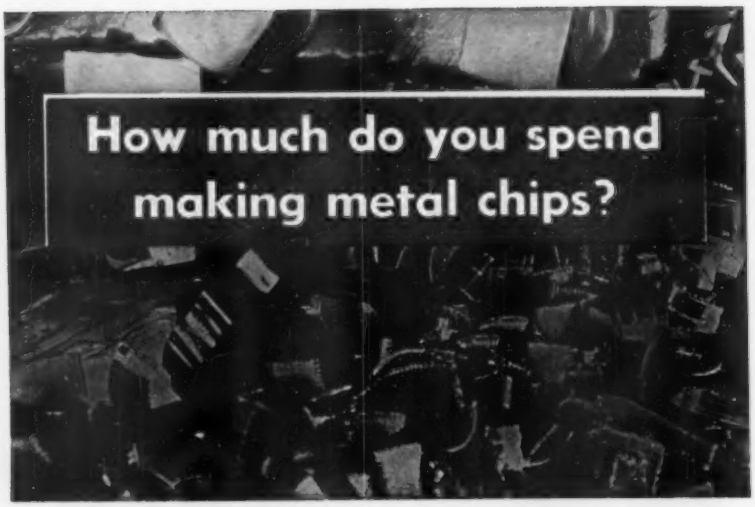
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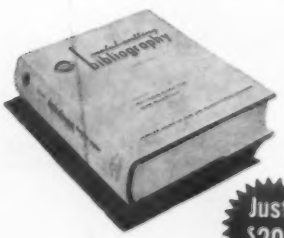
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done before, or (2) does something in a radically different manner so as to potentially obsolete existing products serving this function. An example of (1) is the vacuum tube or a satellite. Examples of (2) are automobiles, transistors that are replacing vacuum tubes, and paper milk cartons.

In selecting a new product for commercialization, six considerations apply: (1) the device or process must work with reasonable reliability; (2) it must be easy to use and safe and preferably provide some degree of personal satisfaction; (3) there must be a reasonable prospect of making a profit; (4) if it is an industrial product, it should preferably be something that is sold to a growing industry; (5) final products are a better selection than component products, as sales of components are determined entirely by the success of some other product; and (6) the key factor is usually the need for the product. Even better than products for existing needs are those products that anticipate needs.

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for by proper marketing, these potential needs can be converted into wants.

Because commercialization of a new product depends on its use, marketing is essential to the success of the product. For instance, in marketing paper milk cartons, it was found that most dairies were reluctant to use the cartons because of existing facilities for handling the milk in glass bottles. It was necessary to create a demand by selling to grocery stores, supermarkets and housewives, before the dairies could be persuaded to use the new product. There is no possibility of finding a set of criteria to determine whether or not a particular idea should be commercialized. In technical design, it is usually the things that are forgotten that cause the trouble.

Care must be taken in selecting a new product. But most important is to analyze marketing problems in advance and to devise a comprehensive program for developing the market potential. Such a plan must be matched to the capabilities of the organization planning to commercialize the product.

From "Selecting Ideas for Commercial Development," C. A. Butler, Diamond Alkali Co., presented before the Cleveland Engineering Society, 3100 Chester Ave., Cleveland 14, Ohio.

Creativity

"Creation is a highly personal thing; it is something younger, poorly paid scientists and engineers do, and older, highly paid ones get together and talk about." So remarked Dr. J. Bronowski, saying that top-level creativity seems to be an attribute of the young man. But paradoxically, the older men can get hearing and support, while the younger creative men cannot. This is to be expected. As Dr. Bronowski says, "Society must resist change while it advocates it . . . Society must . . . encourage these eccentrics while it disapproves of them, for they create problems which society must digest."

The creative person is usually young. Experts say the top age for basic innovations among theoretical physicists and mathematicians is 30 to 35; for experimental physicists, 35 to 40; for biological and medical scientists, 40 to 45. Thus the man with the greatest potential usually is without reputation or experience, and the man with both reputation and experience is unlikely to produce anything basic. Real creativity apparently occurs most often in the unconventional—even eccentric—individual. He has intense faith in himself and a willingness or desire to work alone. He is impatient with conventionality, whether it be rules and regulations, working conditions or mentalities.

Tests during the past six years by UC-Berkeley's Institute of Personality Assessment and Research indicate that intelligence is more important in creativity than education level. But not all intelligent people are creative—many lack the will, desire, and independent judgment. Other uniform characteristics are: an openness to experience (almost naivete); esthetic sensitivity to beauty, particularly in form and dynamic balance; deep concern with the philosophical issues, with the freedom and lawfulness in nature (a strong need for order, but not for conformity unless he's sure it meets nature's laws); and a willingness to stake his future on the meaning of his work.

Creativity is basically the ability to produce new and interesting results from nature—four types are recognized: (1) pure basic research of the Nobel-prize level; (2) innovation and discovery; (3) invention; and (4) problem solving. Creativity is something that industry talks about wanting, and against which it subconsciously erects barriers. Changes bring complications. When familiar ways have to be changed, management subconsciously rebels. On the official level, management hankers for creative technical people, but unofficially, management long since discovered that highly original people are often a major nuisance. They are almost certain to show in their personal behavior the same eccentricities they show in their ideas. They have an exalted opinion of their own abilities. They show great drive and aggression, but frequently not toward management-approved goals. Inventors often are not the "company type," are likely to be antisocial, antiauthoritarian, and may find refuge in excess in personal habits. They regard their work as an expression of their own personalities; it expresses and fulfills their personalities and they tend to feel that they can do everything on the job better than anyone else.

Nor are creative people alike. Dr. Donald A. Schon identifies four types of production thinking: (1) the analytic type defines the problem broadly, makes logical divisions; (2) empirical thinkers tend to operate largely on the basis of experience and seek analogies to solve problems; (3) materials-oriented thinkers do not solve problems conceptually and are likely to humanize materials. They often show great originality and ingenuity; (4) mataphorical thinking is the most obviously creative. This type pursues apparently irrelevant approaches and wide-ranging analogies, treating the problem as though it were something else. They are fluent verbally, but often unable to translate ideas to physical models.

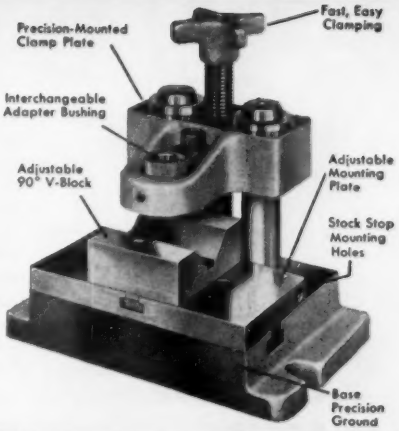
From "Creativity Is a Will-o'-the Wisp" by Elmer J. Tangerman, Product Engineering, presented before the Cleveland Engineering Society, 3100 Chester Ave., Cleveland 14, Ohio.

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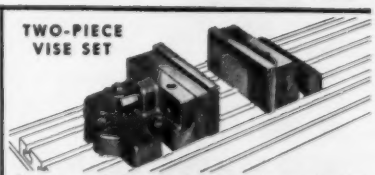


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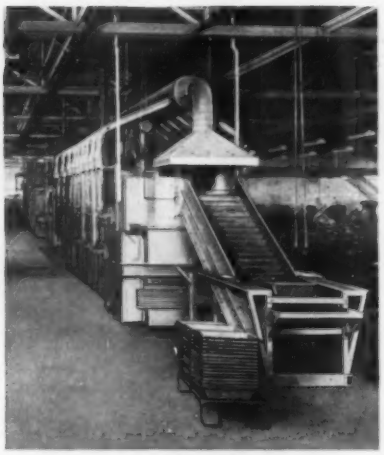
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Science Fact or Fiction

Writers of science fiction were laughed at and ridiculed for years for talking about nonsensical things such as atomic power and rocket ships. They were subject to ridicule because they stuck out their necks and made predictions and unsettled the more sober elements of society. This is one of the main characteristics of creative thinkers—to disrupt, to change or modify what is now existent. Creative thinkers accomplish this in two different ways; one, by adding to the sum of human knowledge; and two, by subtracting from the sum of human nonsense. An example of reducing human nonsense is the observation of ball lightning. Science explains many things, and when it cannot, it explains them away as superstition or folklore. Ball lightning was explained away as superstition — until someone started making plasmoids in a laboratory. Ball lightning is no longer regarded as superstition. Another "superstition" is the belief that insanity is somehow associated with the moon. Now, competent observers have found that admissions to state hospitals for the insane follow the phases of the moon. And a surgeon reports that 80 percent of the hemorrhages following tonsillectomies occur at the full of the moon. Similarly, Dr. Edwin Land recently did some research in color vision and found that the full color effect could be achieved by using two black and white transparencies. When projected on a screen, the full range of color is

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seen. The discovery adds to human knowledge and at the same time subtracts from the sum of human misconceptions.

The only place that research can be done is where the answers aren't known. This is where science starts, and it starts by speculation, or what has been called fiction. For it is not necessary to know why something works, it is only necessary to know how something works. Edison did not know what electric current was, but he nevertheless could work with it. Science is a convenience, making engineering easier, but the Roman engineers, who had no science, proved that it is not necessary to the engineer. This poses a fundamental question for creative, original researchers—which is truest or closest to reality, fiction or logical fact?

From "Science Fact or Fiction," by John W. Campbell Jr., editor Astounding Science. Presented before the Cleveland Engineering Society, 3100 Chester Ave., Cleveland 14, Ohio.

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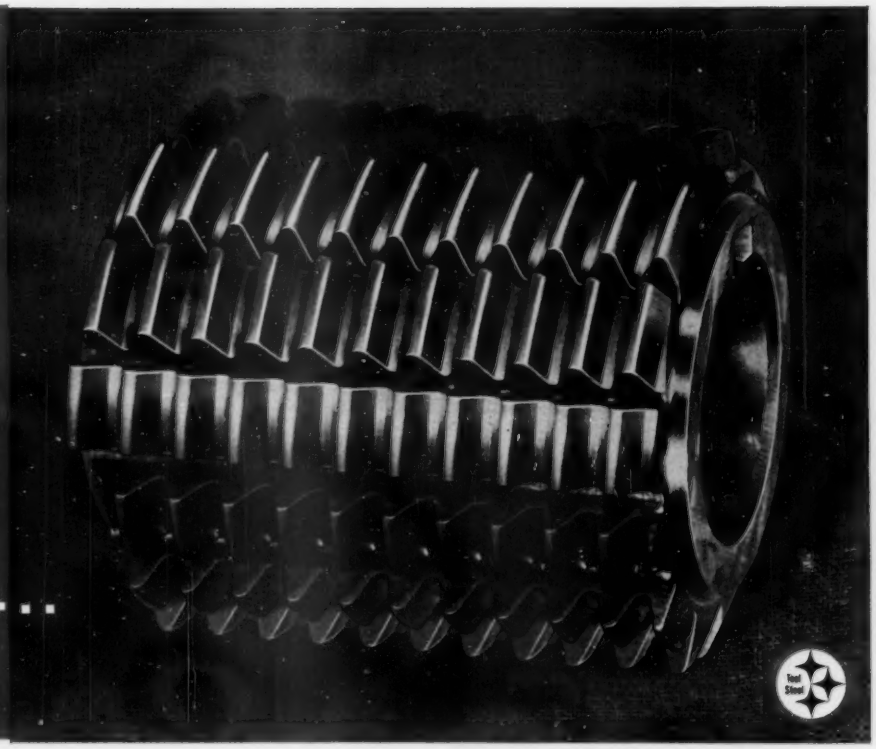
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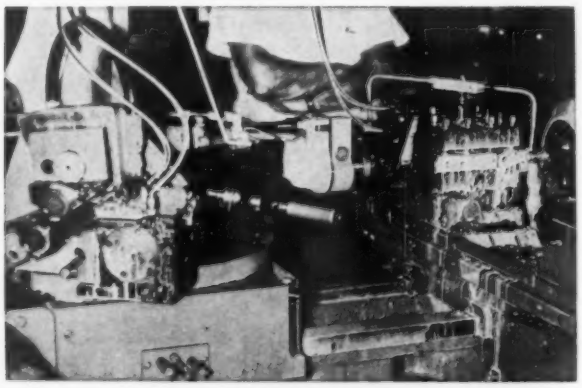
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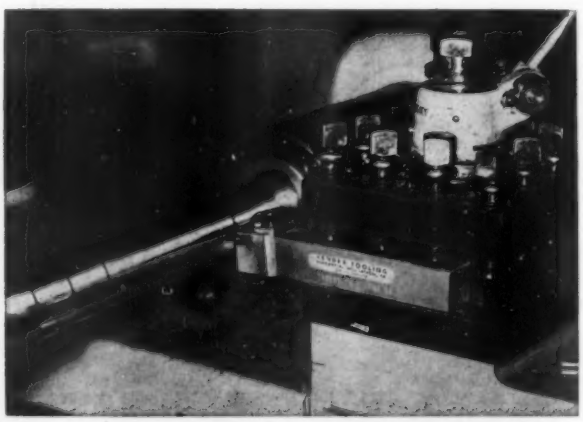
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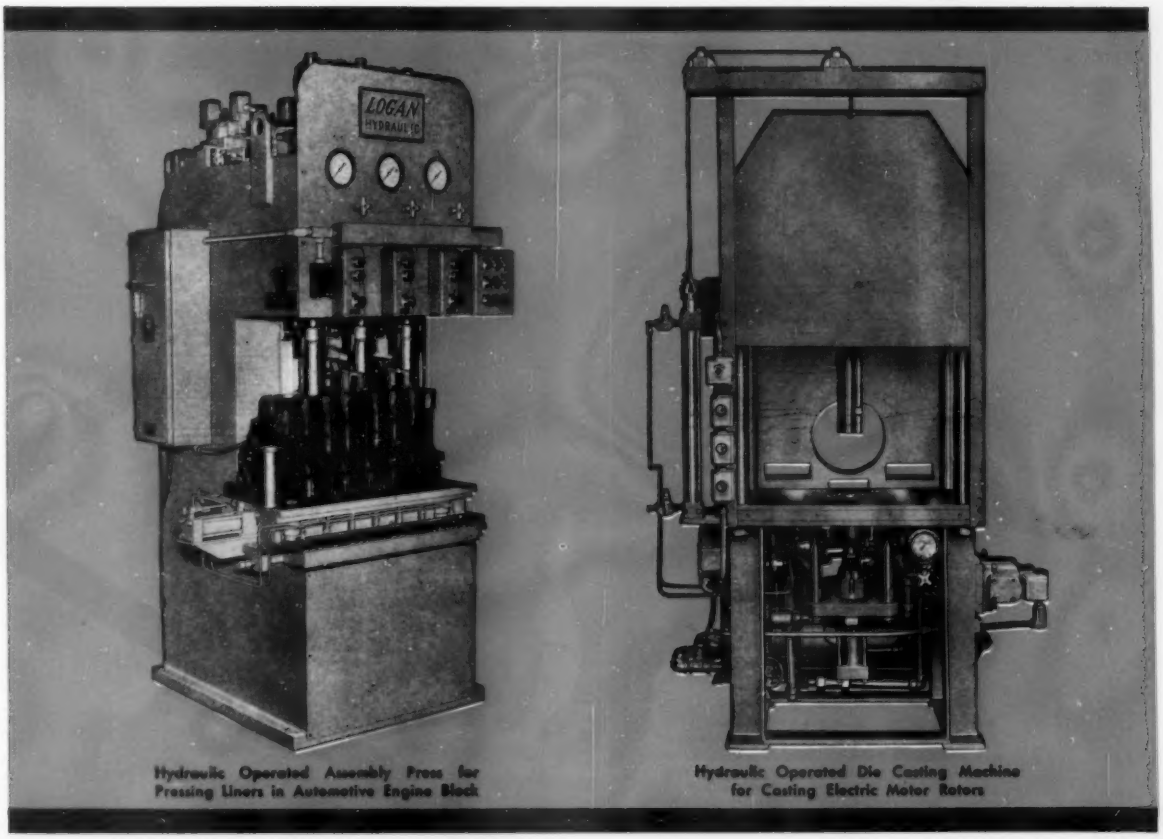
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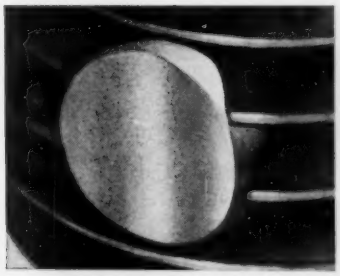
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- Cut maintenance—by reducing time spent inspecting joints and tightening loose fasteners.
- Cut downtime—won't budge even in the face of severe impact, shock, vibration.
- Cut damage to machinery, which results when screws come loose.

UNBRAKO socket screws with Nylok are easily removable, repeatedly reusable (pellet seeks to regain original shape when removed). For complete information, see your authorized industrial distributor or write SPS — manufacturer of precision threaded fasteners and allied products in many metals.

*T.M. Reg. U.S. Pat. Off., The Nylok Corp.



INDUSTRIAL FASTENER Division

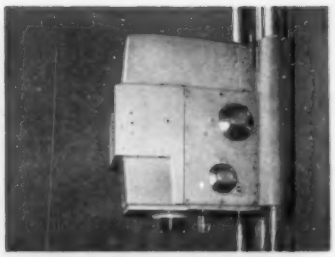
JENKINTOWN 37, PENNSYLVANIA

sps

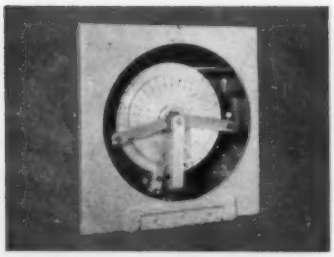
where reliability replaces probability



NEW To control hone feed, simply adjust this dial on the set-up panel. Infinite adjustments are possible.



NEW Multiple speed control dial changes spindle speeds at a flick of the fingers.



NEW Reciprocation dial on Models 244 and 3010, and calibrated scale on Model 122, permit fast stroke control.

35 YEARS OF BARNESDRIL HONING EXPERIENCE

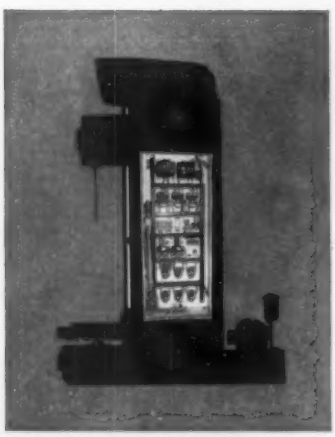
3 ARE WRAPPED UP IN THESE NEW HONING

Perhaps you saw them for the first time at the Machine Tool Show . . . a complete, new line of BarnesdriL high production honing machines. They're new from top to bottom . . . every feature exactingly engineered to cut costs and step-up production.

You'll find amazing new versatility . . . a broad range of capacities . . . greater ruggedness . . . more compact design . . . easier maintenance . . . new features galore! These BarnesdriL honers provide fast stock removal and precision control of bore size at high production rates.

We've incorporated 35 years of honing experience in them to give you machines that hone more economically than ever before.

If you'd like to know more, we'll be glad to send complete details. Of, if you prefer, a BarnesdriL sales engineer will call in person.



NEW Electrical controls are mounted inside the column of the machine to eliminate external panels.

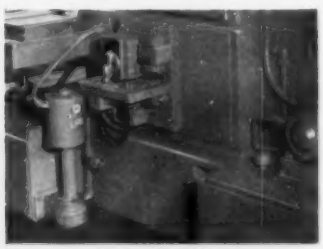
BARNESDRIL HONING MACHINES

BARNES DRILL CO.

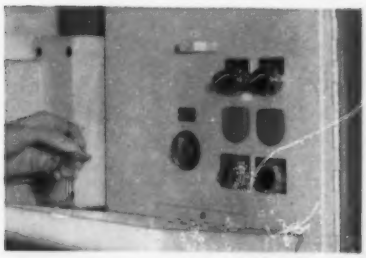
870 CHESTNUT STREET — ROCKFORD, ILLINOIS
DETROIT OFFICE—13121 PURITAN AVENUE



NEW Operating control panel placed at shoulder height away from splash of coolant.



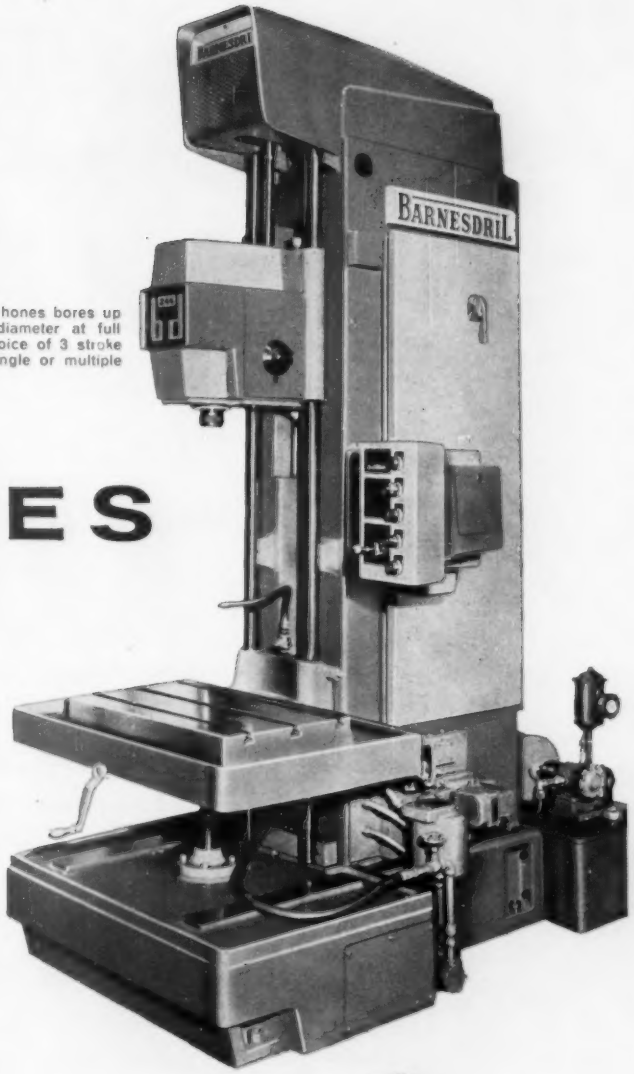
NEW Coolant pump is in the open for easy maintenance. Coolant reservoir is part of machine base!



NEW Positive protection against tampering with set-up controls guarded by lock and key.

1

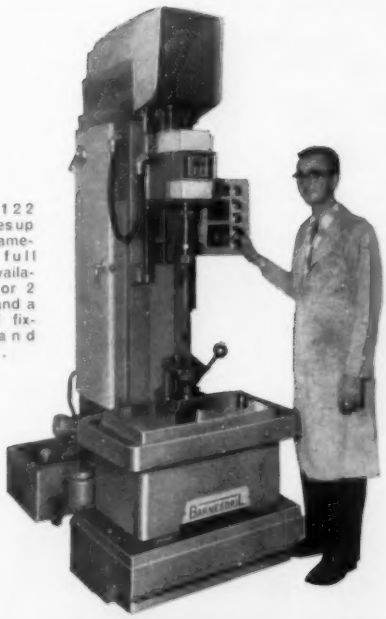
Model 244 hones bores up to 4" in diameter at full stroke. Choice of 3 stroke lengths, single or multiple spindles.

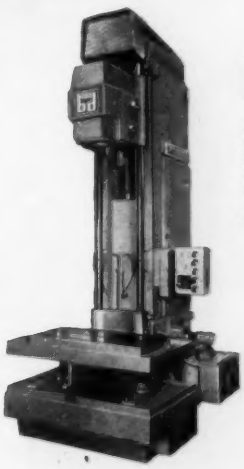


MACHINES

2

Model 122 hones bores up to 2" in diameter at full stroke. Available in 1 or 2 spindles and a variety of fixtures and tables.



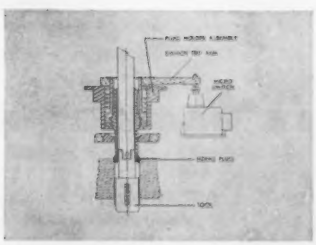


3

Model 3010 hones up to 10" diameter at full stroke. Choice of 4 strokes. Adaptable for full automation.

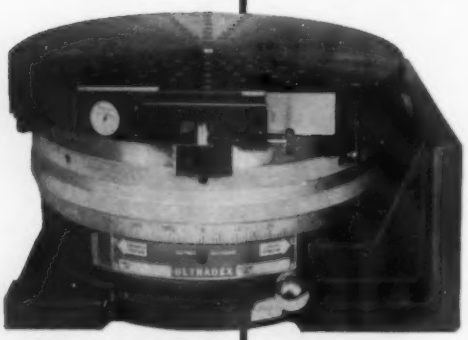


NEW Easy-to-reach hydraulic pump and controls instantly accessible for periodic checking and servicing.



Exclusive BarnesdriL Plugmatic bore-to-bore sizing maintains size consistency within .0002" on production runs!

Use Reader Service Card, CIRCLE 165



Ultradex high precision indexing table

"In-Process" Inspection to Millionths

Inspecting a workpiece with laboratory accuracy while mounted in machining position greatly reduces scrap in high precision missile components. The Ultradex provides this checking ability while, at the same time, serving as a machining fixture. The Ultradex has a radial locating and indexing accuracy of ¼ second of arc, or six millionths of an inch at a one-foot diameter. Table surface is flat and parallel within 0.000050 inches. Large 12″ diameter with ample radially dispersed threaded holes permits easy attachment of workpieces or fixtures. Sealed design allows use in operations requiring coolants or lubricants.

AA GAGE COMPANY

350 Fair Street • Detroit 20, Mich.

Booth 240, ASTME Western Engineering Conference & Exhibit, Los Angeles, November 14 thru 18

NOW 7* STANDARD LAPMASTERS

FOR PRECISION LAPPING

to a flatness of .0000116" or less with a micro-inch finish of 2 to 3 RMS. All Lapmasters will maintain this uniform accuracy piece-after-piece because conditioning rings continually condition the lap plate during entire lapping cycle.

IN SMALL LOTS OR THOUSANDS PER DAY

with consistent accuracy. Production is not interrupted or slowed down for replacing or reconditioning lap plates.

OF PARTS UP TO 32" DIA.

and as small as ⅛" dia. Accurately laps paper-thin pieces as well as giant two-ton parts.

OF ANY SHAPE, FORM OR MATERIAL

tall or squat, long or short, flat or odd shaped... any metal, ceramics or plastic all at the same time if necessary. Inexpensive work holders eliminate danger of stresses and warping usually caused by clamping during grinding or milling.

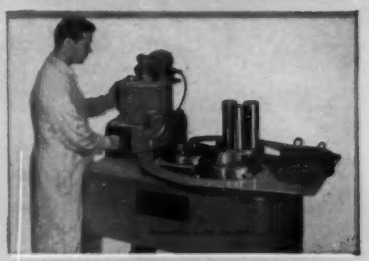
*For your special lapping requirements, we will build Lapmasters any size.



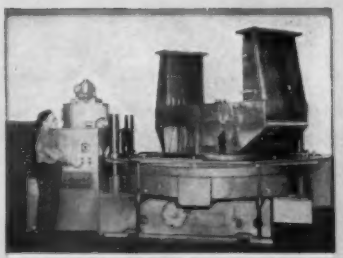
MODEL 10 for maintenance lapping of parts up to 3-11/16" dia.



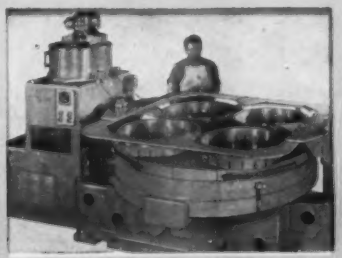
MODEL 12 for parts up to 4" dia.



MODEL 24 for parts up to 9½" dia.



MODEL 84 for parts up to 32" dia.



MODEL 72 for parts up to 27" dia.



MODEL 36 for parts up to 14½" dia.

WRITE FOR THE COMPLETE LAPMASTER STORY

Write for bulletins describing the Lapmaster line and chart on measuring flatness.





MODEL 48 for parts up to 17" dia.

Lapmaster®

...THE MACHINE THAT PUT PRECISION LAPPING ON A PRODUCTION BASIS

A product of

Crane Packing Company

6469 OAKTON STREET • MORTON GROVE, ILLINOIS (Chicago Suburb)

In Canada: Crane Packing Company, Ltd., Hamilton, Ont.

Gage Blocks of CARMET Chromium Carbide



for new standards of dimensional control!

For enduring, ultra micro-accurate surface finishes and dimensional stability, CARMET Chromium Carbide represents the ultimate gage block material.

Harder by nature than steel . . . next to a diamond in hardness, yet far tougher . . . Chromium Carbide Gage Blocks withstand rougher use, eliminate costly dimensional errors, and cut frequency of calibration and replacement. They have a thermal coefficient of expansion similar to steel. Fingerprints are not harmful.

Lightweight, non-oxidizing, possessing superior "wringability" and a stable, fine grain structure that takes and holds a mirror-smooth gaging surface . . . CARMET Chromium Carbide in gage blocks is leading the way to rigid new standards of dimensional control.

Carmet doesn't make gage blocks, but furnishes the chrome carbide to the progressive manufacturers who do.

A precise blend of extremely hard, finely divided carbides of chromium with a nickel binder, CARMET Chromium Carbide assures predictable, consistent behavior and unmatched uniformity from piece to piece.

These same unique characteristics make CARMET Chromium Carbide an important material for extrusion dies, valve seats, sealing rings, chemical processing equipment . . . or any other application where resistance to oxidation, corrosion, abrasion, erosion or chemical attack may be involved. For more information, contact your local Allegheny Ludlum CARMET representative, or write: ***Allegheny Ludlum Steel Corporation, Carmet Division, Ferndale, Detroit 20, Michigan.***

1726

CARMET® AL

CEMENTED CARBIDE · DIVISION OF ALLEGHENY LUDLUM

BATH Tap'n Gage TIMES

A series of technical discussions that will be helpful in getting better results from tapping and gaging operations

Vol. 1 No. 18

Subject: Standard System of Marking Ground Thread Taps:

Recognizing the importance of a standard system of marking, most tap manufacturers mark their product with the nominal size, number of threads per inch and the proper symbols to identify the thread form and the pitch diameter limit. Shown below are some of the symbols used.



PITCH DIAMETER LIMIT SYMBOLS

"G" signifies Ground Thread
"H" (High) signifies the pitch diameter is above basic
("L" (Low) replaces the letter "H" to signify the pitch diameter is below basic)

The numeral following "H" or "L" signifies the number of .0005" steps above or below the basic pitch diameter.

Standard Taps 1" diameter and smaller are ground to a .0005" tolerance on the pitch diameter and are marked with one of these corresponding pitch diameter limits:

L1 = Basic to basic minus .0005"
H1 = Basic to basic plus .0005"
H2 = Basic plus .0005" to basic plus .0010"
H3 = Basic plus .0010" to basic plus .0015"
H4 = Basic plus .0015" to basic plus .0020"
H5 = Basic plus .0020" to basic plus .0025"
H6 = Basic plus .0025" to basic plus .0030"

Standard Taps larger than 1" diameter are ground to a .0010" tolerance on the pitch diameter and are marked with this pitch diameter limit:

H4 = Basic plus .0010" to basic .0020"

COMMON THREAD FORM SYMBOLS

NC American National Coarse Thread Series
NF American National Fine Thread Series
NEF American National Extra Fine Thread Series
N American National 8, 12 and 16 Thread Series
NM National Miniature Screw Thread
NS American (National) Special Thread (60° Thread Form)
NPT American (National) Taper Pipe Thread
NPTF Dryseal American (National) Taper Pipe Thread
PTF Dryseal SAE Short Internal Taper Pipe Thread
ANPT Military Aeronautical Pipe Thread Specification MIL-P-7105
NPS American (National) Straight Pipe Thread
NPSC American (National) Straight Pipe Thread in Pipe Couplings
NPSF Dryseal American (National) Fuel Internal Straight Pipe Thread
NPSI Dryseal American (National) Intermediate Internal Straight Pipe Thread
ACME C Acme Screw Thread—Centralizing Type
ACME G Acme Screw Thread—General Purpose Type
STUB ACME Stub Acme Threads
V A 60° "V" Thread with truncated crests and roots. The theoretical "V" Form is usually flatted several thousandths of an inch to the users specifications.
STI Special Threads for Helical Coil Wire Screw Thread Inserts

Special Ground Thread Taps with multiple threads are marked with the nominal size, number of threads per inch, form of thread and lead designated in fractions; also double, triple, etc.

Example: A 1" — 8 Double Thread Special Tap with National Form of thread is marked:

1" — 8 N.S. DOUBLE
¼" LEAD

Note: For additional tap and gage information, contact your Bath distributor — or, write direct.

•Cylindrical and Thread Gages •Ground Thread Taps •Internal Micrometers John BATH & Co., Inc.
28 Mann Street, Worcester, Mass.

Atrax

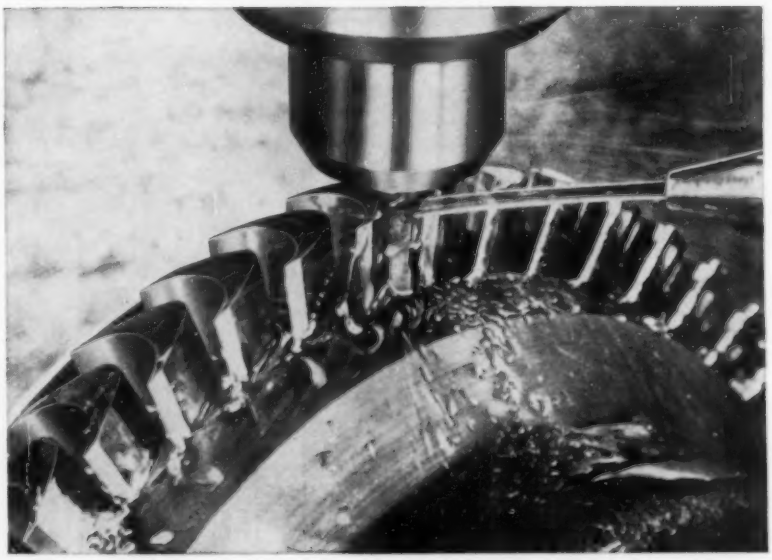
Precision Ground
SOLID CARBIDE
TOOLS AND BURS

Job Applications



Solid carbide, 6 flute, ball nose, right hand spiral end mill .170" in diameter easily cuts rugged stainless steel alloy impeller buckets to close, uniform tolerances.

EXOTIC MATERIALS PROVE EFFICIENCY OF ATRAX SOLID CARBIDE END MILLS...



This Atrax end mill was produced as a special only to satisfy exacting tolerances on this extremely tough stainless steel alloy.

PRODUCTION UNIFORMITY

Milling cut was ½" deep. Work piece was held and rotated by means of a cam controlled fixture, the spindle and end mill were stationary. 42 buckets per impeller wheel had to be uniform in size, shape, weight and balance.

LONG TOOL LIFE ESSENTIAL

Because of the close tolerances required, end mills could not be resharpened so that maximum production without changing tool cutting characteristics was vital. Atrax end mills out-produced all others.

SIMILAR SUCCESS MILLING TITANIUM BUCKETS WITH 1/16" DIAMETER ATRAX END MILL!

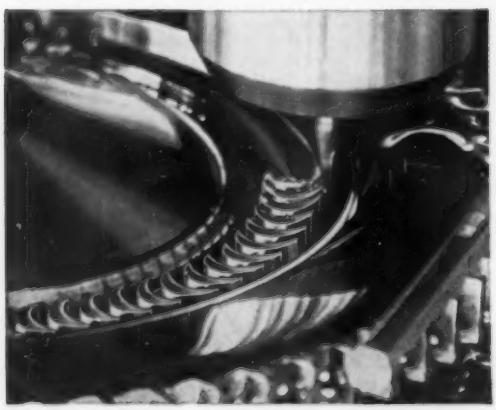


Photo shows a 1/16" diameter Atrax End Mill profiling to fine micro-finish buckets of a titanium turbine impeller. Each Atrax tool completed 72 buckets on each of 4 impeller wheels before replacement. The production performance proved far superior to high speed steel that deflected and broke under initial cut and competitive solid carbide end mill that produced profiling cuts on only 36 buckets before failure.

There's an Atrax Solid Carbide End Mill job engineered for virtually every end milling material and application.

Send for your copy of the 148 page Atrax Catalog.



THE ATRAX COMPANY
240 DAY STREET, NEWINGTON 11, CONN.

EX-CELL-O CONTOUR PROJECTORS GIVE YOU MORE—

1. **LARGEST WORK AREA**—Regardless of magnification there is a constant eight inches of work space from lens to focal plane to accommodate large objects. The Model 30 has a 12" diameter capacity.

2. **UNSURPASSED ACCURACY**—Kodak optics with famed Ektar® lenses guarantee accurate measurements and give clear undistorted images over entire screen. You can depend upon optical decisions made on the Ex-Cell-O.

3. **TRUEST MEASURING PRECISION**—All Ex-Cell-O Contour Projectors read to tenths and measure to tenths. Each Ex-Cell-O contour projector is tested and checked to the highest laboratory standards before shipping.

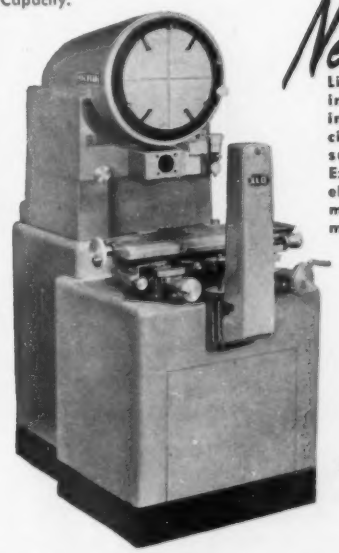
4. **BRIGHTEST GLARE FREE SCREEN**—Coated lenses and mirrors have been standard on all Ex-Cell-O models for many years. The patented "Fresnel" lens (exclusive with Ex-Cell-O) brings entire screen into clear view from normal operator position. Sharp clear images in normal room light—the brightest and clearest in the contour projector field!

5. **MOST RUGGED CONSTRUCTION**—Built to "stand the gaff." Solid construction with optical system locked into lifetime cabinets. Will withstand factory wear and tear—without getting out of adjustment. Guaranteed by Ex-Cell-O's long experience in the manufacture of precision machine tools.

6. **SIMPLEST OPERATION**—Finger tip controls, cool to the touch lamphouses, simple setting and measuring devices, unreversed images, all add up to comfortable day long operation. A precision machine of great accuracy that can be quickly mastered by average factory inspection personnel.



MODEL 30
A True, Heavy Duty Precision Measuring Projector with 30" Diameter Screen, and 12" Diameter Capacity.



New! **The Ex-Cell-O Mercury Arc Light Source Accessory. A high intensity Accessory light source including Mercury Arc Lamp, special collimator and auxiliary power supply. Quickly adaptable to all Ex-Cell-O Contour Projector Models (except Model 8) to give maximum screen brightness at higher magnifications.**

Write for new booklet "See The Savings" which graphically demonstrates time savings through optical gaging over conventional methods.

MODEL 14-5
The Finest, Most Versatile, 14" Screen Contour Projector Available.

Manufactured by EX-CELL-O Corporation of Detroit, Mich.

SOLD AND SERVICED BY

OPTICAL GAGING PRODUCTS, INC.

26 FORBES STREET ROCHESTER 11, N. Y.

(A subsidiary of EX-CELL-O Corporation)

Adamas Carbide's Record at Ford

...proves it pays to select by performance!

ADAMAS JOB REPORT FOR:

Ford Motor Company

PLANT: Sterling Plant, Warren, Mich.

PART(S): Ford Rear Axle Shafts—No. 4235

MATERIAL: SAE-1038 Steel Forging, Brinell 179-229

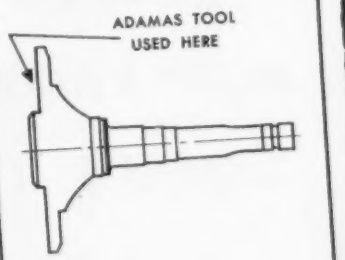
MACHINE: Snyder Lathe

OPERATION: Flange Facing—6.47 flange OD to 2.46 pilot diam. ... 930 to 360 sfpm. ... feed .016 ... depth of cut .030 to .090 variable

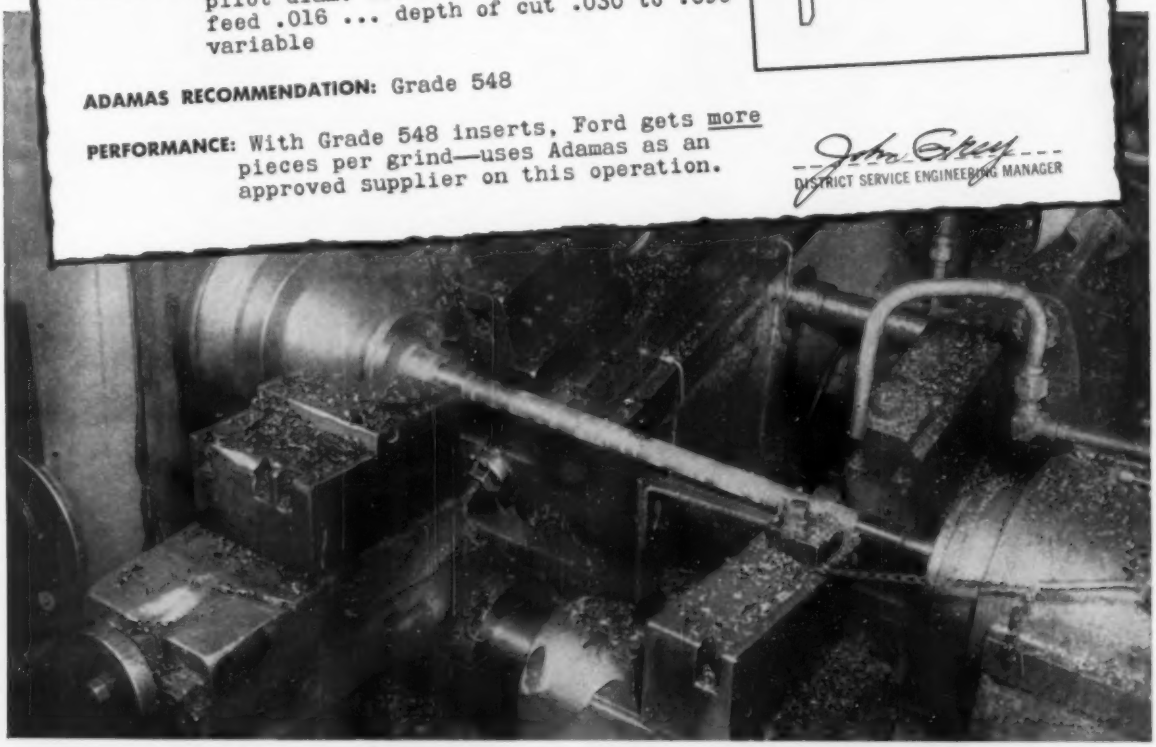
ADAMAS RECOMMENDATION: Grade 548

PERFORMANCE: With Grade 548 inserts, Ford gets more pieces per grind—uses Adamas as an approved supplier on this operation.

OPERATIONAL DIAGRAM



John Grey
DISTRICT SERVICE ENGINEERING MANAGER



■ The ability of Adamas Grade 548 to face flanges on more rear axle shafts, at minimized tool grinds, has greatly assisted in enabling Ford to substantially increase production. It has also played a part in Ford's obtaining lower tool costs ... longer tool life ... less machine downtime ... faster feeds ... variable speeds ... virtual elimination of rejects.

■ Grade 548's record 6-year run at Ford: optimum capability for consistent high performance and profitable volume production ... Another outstanding example of what is being accomplished by Adamas in plants of all sizes throughout the country.

■ Adamas produces standard and special tungsten carbide products for every metalworking application. For details on Adamas Performance-Proved carbide products best suited to your requirements contact your nearest Adamas representative or write direct.

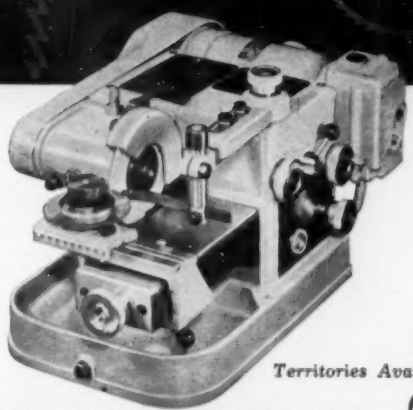
FREE: Ask for your copy of NEW ADAMAS PRICE LIST No. PL-960.

Producers of Tungsten Carbide Tools, Tool Tips, Dies, Wear Parts, Dex-A-Tool, Dex-A-Mil

ADAMAS CARBIDE CORPORATION
KENILWORTH, NEW JERSEY

PROGRESSIVE CARBIDE USERS SELECT BY *Performance*...NOT HABIT!

TEMPO automatic



Territories Available

AS-SERIES SAW SHARPENING MACHINES
FOR CIRCULAR SAW BLADES,
BAND SAW BLADES, HACKSAW BLADES.

EXCLUSIVE REPRESENTATIVE IN USA:

CAWI MACHINE CO. INC.

34 EXCHANGE PLACE, JERSEY CITY 2, N. J., Phone: HEnderson 5-9330

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WORLD'S LARGEST SELECTION OF

DECIMAL REAMERS and COUNTERBORES

WHY BUY SPECIALS
WE STOCK Thousands by the THOUSANDTHS!



Write for REVISED Catalog

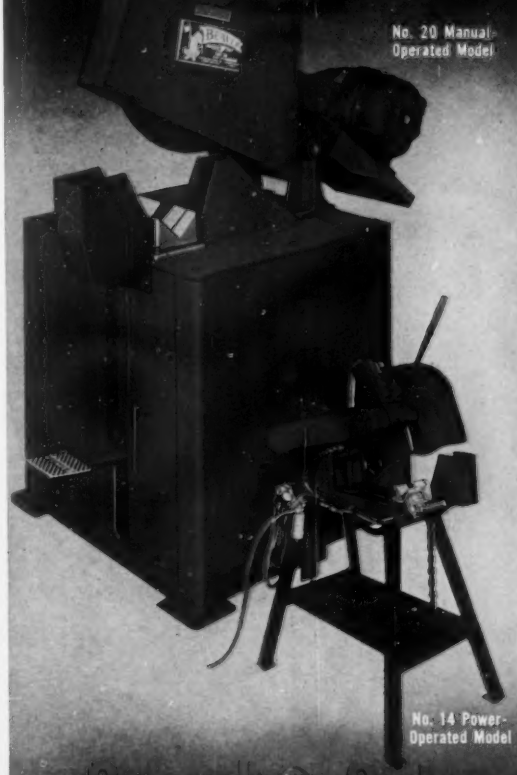
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Box 429-TE Libertyville, Illinois

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CUT TIME! CUT COSTS!
CUT ALMOST ANYTHING IN SECONDS!



Speed Cut

Abrasive Cutting Machines

MANUAL OR POWER-OPERATED MODELS
FOR WET, DRY OR ANY-ANGLE CUTTING!

Speed Cut — *Send for complete catalog and name of nearest distributor*

ABRASIVE MACHINE DIV.
BEAVER PIPE TOOLS, INC.
DANA AVE.
WARREN, OHIO

Use Reader Service Card, CIRCLE 175

HY-PRO

Co-form® X-PRESS® TAPS

Manufactured under license from Besly-Welles Corporation

for tapping threads without cutting



NOW — from HY-PRO you can get the newest in tap design — Co-form X-Press fluteless taps that are setting cost-reduction records on many jobs that were formerly "tap-killers."

HY-PRO Co-form X-Press taps cold-form threads in through or blind holes, with these advantages . . .

No Chips to clog and cause tap breakage — no chip removal problems • **Permit Faster Tapping Speed** and boost production from automatic equipment **Provide Accurate Control** of hole size — cannot be forced into lead error • **Eliminate Blind Hole Tapping Problems** — no chips to jam at bottom • **Form Stronger Threads** with better holding power • **Taps Are Stronger** without flutes, especially in smaller sizes **Taps Last Longer** and maintain accurate size tolerance **More Holes Per Tap** — up to 40 times greater tap life.

Tap for less with Co-form® X-PRESS®

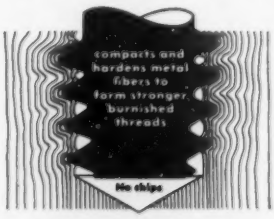
®X-Press is a registered trademark of Besly-Welles Corporation. ®Co-form is a registered trademark of Hy-Pro Tool Company.

Recommended for tapping . . .

Copper Brass Lead
Aluminum Zinc
Steel Magnesium
Die Castings
Leaded Steel
Stainless Steel
— other ductile metals

Tapping operation is the same

Conventional methods and equipment are used, except for change to larger tap drill sizes.



HY-PRO

STANDARD TAPS FROM STOCK

for "most holes per tap" – in any material



Hand and Machine Screw | Spiral Point | Fluteless Spiral Point | Spiral Flute | Special Application | Pulley | Acme | Taper Pipe Spiral Flute | Straight Flute

Hy-pro Tap Engineering Specialists will help you find out quickly how much you score on "cost per tapped hole." Their job analysis regularly leads to savings of 50% or more — often with a simple switch to the right style of standard taps. Write for complete information. Find out how much you can save.

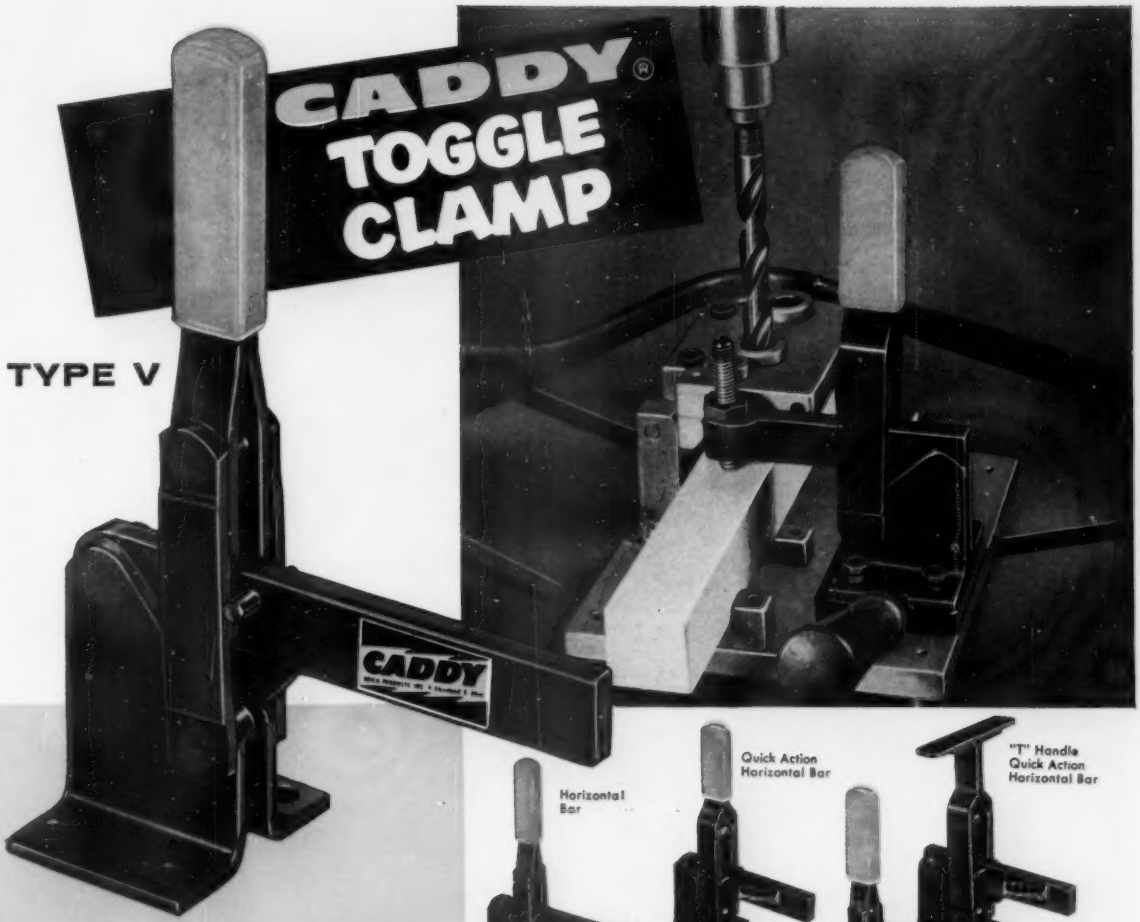
For standard taps from stock, call your local **Hy-pro Tap Distributor.**

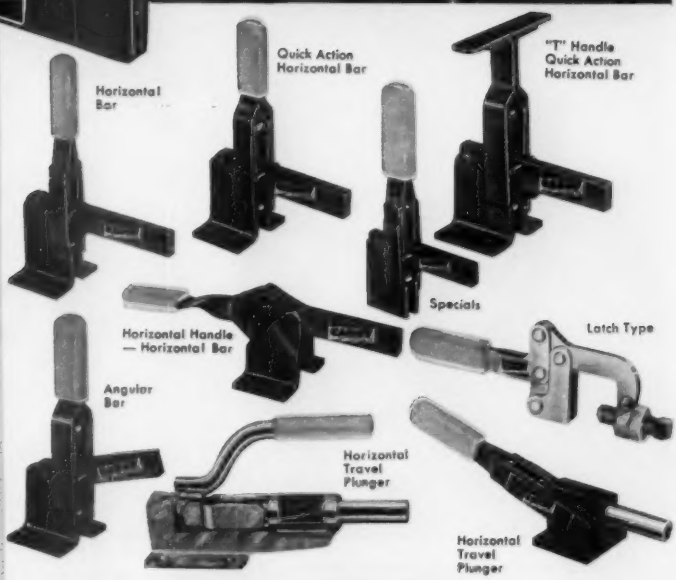
HY-PRO TOOL COMPANY

NEW BEDFORD, MASS., U. S. A.

CADDY® TOGGLE CLAMP

TYPE V





CADDY Type V Toggle Clamps feature all welded construction. Four sizes are available with clamping pressures from 800 lbs. to 2,000 lbs. Built to outlast any clamp on the market. Clamps have black finish with yellow plastic handles. Bolt retainer is furnished with each clamp.

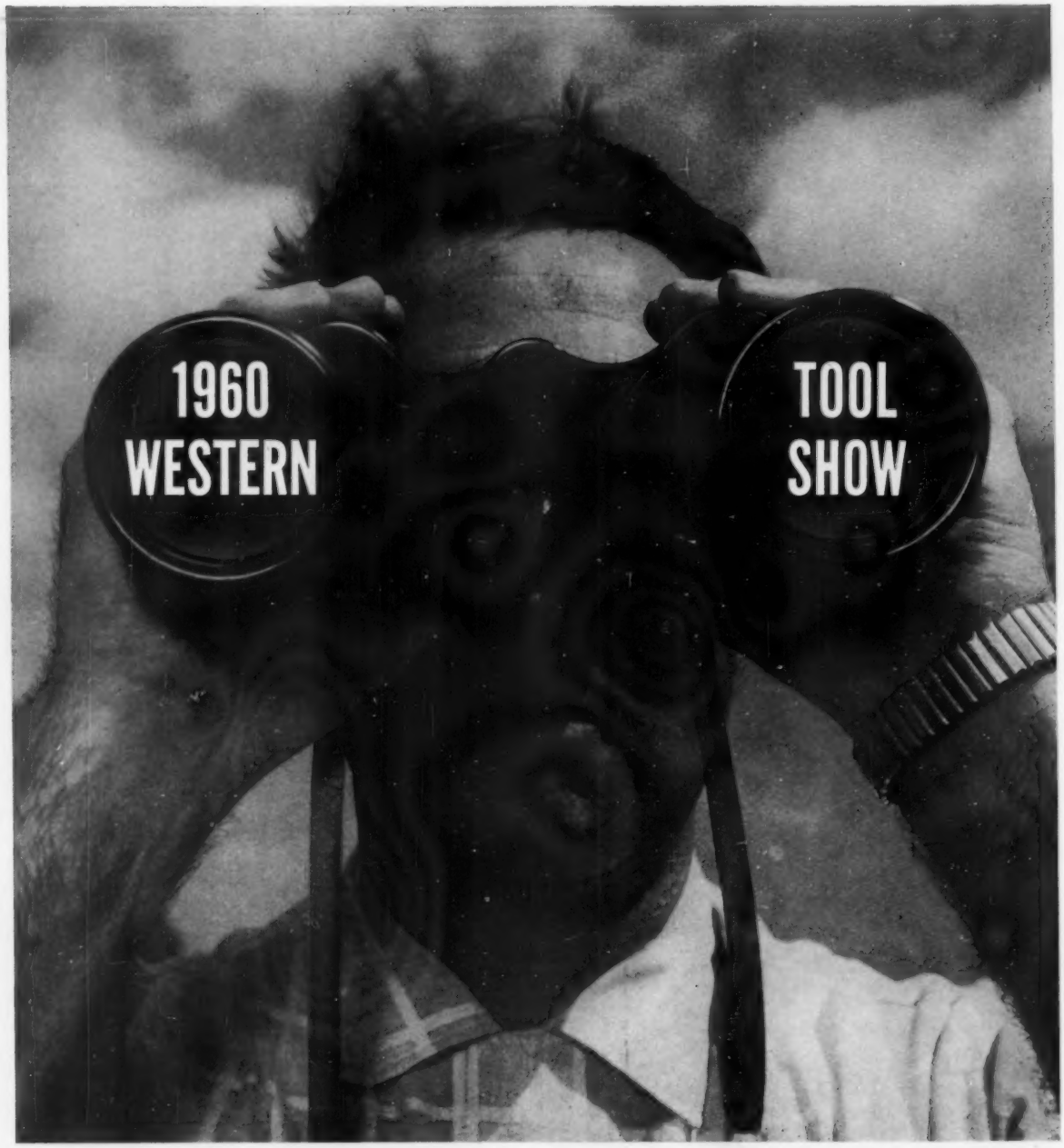
1. **EXTRA LARGE PIVOT PINS—Up to 3 times more bearing surface than other clamps. In actual test under load, V-3 clamp withstood 250,000 cycles without excessive wear.**
2. **ALL WELDED CONSTRUCTION—Will not come apart even after pins become excessively worn.**
3. **HEAVIER FRAME—Will not spring or bend under maximum load.**
4. **HEAVIER LINKS AND HANDLE—Will withstand extreme abuse. Pipe extension handle may be used without damage to linkage.**
5. **REINFORCED CLAMP BAR—Eliminates weak point where pivot pins pass through bar.**
6. **DOUBLE CLAMPING PRESSURE—Design of linkage provides double the clamping pressure of competitive clamps at the same pressure on the handle.**

CADDY®

Toggle Clamp Div. ERICO PRODUCTS, INC.
2070 E. 61st Place Cleveland 3, Ohio

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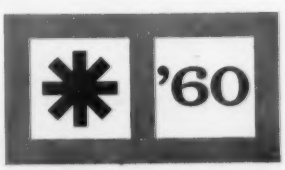
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Lee Alspaugh, Maintenance Foreman, Carlisle Tire & Rubber Co., says that Micro-Fog Lubrication has proved ideal for the bearings and gears on this warm-up mill.

Norgren Micro-Fog Lubro-Control Unit

Norgren Micro-Fog improves lubrication on heavy machinery at Carlisle Tire & Rubber

...minimizes housekeeping problems

At Carlisle Tire and Rubber Division of Carlisle Corporation, Carlisle, Pennsylvania, drip-feed oilers proved unsatisfactory for lubricating the gears and bearings of warm-up mills. Early in 1959, a Norgren Micro-Fog Lubro-Control Unit was installed on one of the mills. The unit lubricates the bearings for the 5′ long, 20″ and 22″ diameter rolls. It also lubricates the gears—a 63″ pitch diameter 12″ face bull gear with a 16″ pitch diameter 12½″ face pinion.

The Norgren Unit automatically and continuously applies an exactly metered amount of fresh, clean oil to each bearing and gear.

Carlisle reports that bearings run cooler and quieter, and wear on gears and bearings is now at a minimum. Less lubricant is needed, servicing is quicker, and messy housekeeping conditions around the machine have been eliminated. As a result, Carlisle is converting other critical machines in the plant to Micro-Fog lubrication.

Norgren Micro-Fog Lubrication gives you these money-saving benefits:

1. Automatic, continuous lubrication in exactly metered amounts
2. Better lubrication—less machine downtime.
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4. Fewer service points—centralized lubrication.
5. Lower bearing temperatures.
6. Longer bearing and gear life.
7. Lower costs for lubrication maintenance.
8. Low lubricant consumption—lower cost for lubricant.
9. Elimination of product contamination by lubricant.
10. Elimination of fire and safety hazards from dripping lubricant.
11. Visible oil feed.
12. Elimination of many oil seals.
13. Oil always fresh and clean—no recirculation.
14. Elimination of oil filters, sumps and pumps.

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For complete information about how Norgren Micro-Fog Lubrication can make big savings in your plant, call your nearby Norgren Representative, listed in your telephone directory—or WRITE FOR DESCRIPTIVE LITERATURE.



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line of **CrysCoat**® processes for

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. . . for better rust prevention
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Lock paint on . . . lock corrosion out: ALL Oakite CrysCoat processes do both by converting a steel surface into an integral "toothed" layer of rugged phosphate crystals. Yet they're different enough to let you *job-match* a pre-paint treatment to the product service conditions and to your production setup—for *lowest unit costs.*

There's a spray-wash or tank immersion phosphate treatment for saving on heating costs . . . for easy control . . . for faster production . . . for smoother paint films . . . for heavy duty protection. Pick the ONE that's right for you.

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Oakite CRYSCOAT 187: NEW—iron phosphate treatment. Specifically designed for application by tank immersion. Provides new detergent and solvent action to assure greater cleaning efficiency . . . more thorough removal of smut from steel. Has built-in pH control. Offers longer solution life.

Oakite CRYSCOAT 89: economical, iron phosphate. Works in spray washing machine without foaming. Easy to control, requires no stainless steel equipment. Bulletin F-10301.

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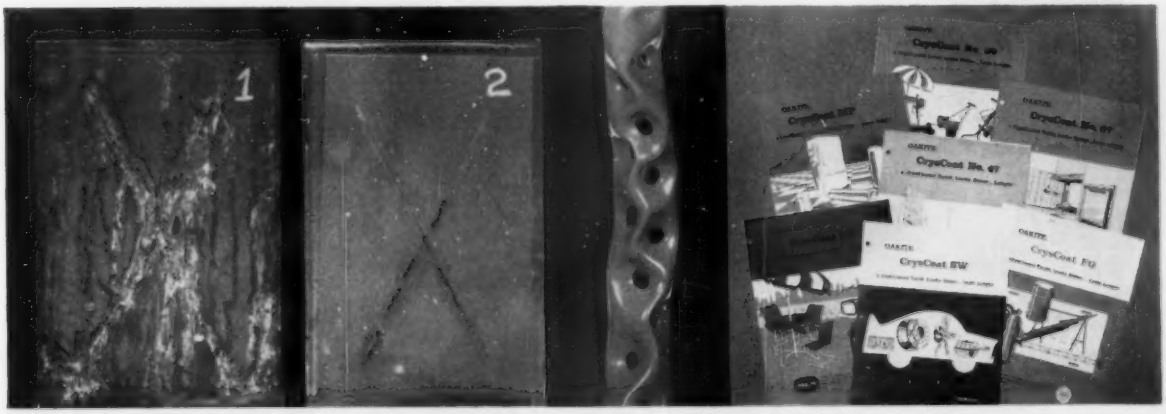
The local Oakite man offers his technical service on a local basis—promptly. There are 250 like him—experienced in all phases of phosphating and its benefits. Call him in, or write for the bulletins mentioned under each process description. Oakite Products, Inc., 17 Rector Street, New York 6, N. Y.

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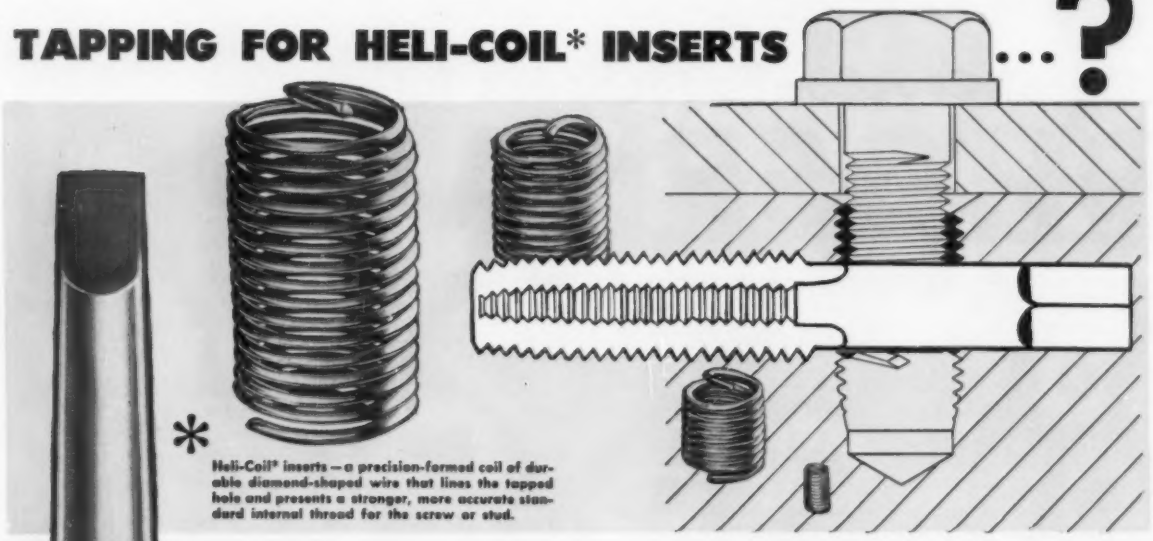
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Longer-lasting: These two panels were identically painted; scored with an "X" and exposed to salt spray test for 480 hours. The big difference: right-hand panel was first treated with an Oakite CrysCoat iron phosphate coating.

Better-looking: This tubing was CrysCoated, painted, and then subjected to repeated punching. Despite the severe abuse, paint film still grips tight—*still* looks good.



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Heli-Coil* inserts—a precision-formed coil of durable diamond-shaped wire that lines the tapped hole and presents a stronger, more accurate standard internal thread for the screw or stud.

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Mohawk Subland Drill-Chamfer "Standards" will streamline those all-important hole drilling operations prior to tapping, by combining both drilling and chamfering into *one* simple, simultaneous one-tool application.

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Mohawk "Standards" are faster and economical to use. They outlast *ordinary* tools, yet remain accurate through regrinds right down to the shank. Better yet, they are available—everywhere!

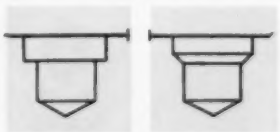
STANDARD SUBLANDS are stocked in all practical sizes and combinations in 3 step lengths, 3 shank styles.



Short Medium Long

REMEMBER, TOO...Mohawk Standard Subland Drills are also immediately available in Drill-Counterbore and Drill-Drill Types. All practical sizes, step lengths and shank styles.





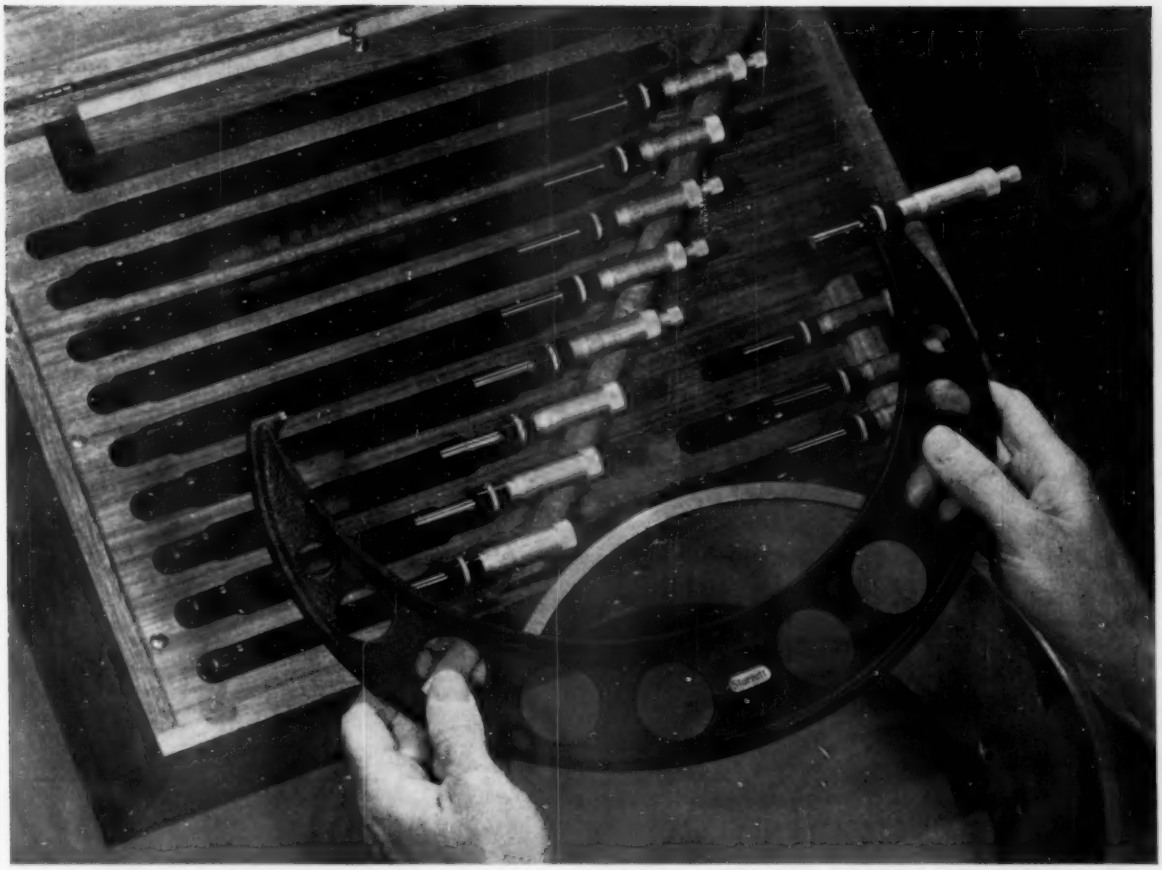
Subland Drill-Counterbore for Socket Head Cap Screws

Subland Drill-Drill for Tap Drill and Body Clearance

*REG. U. S. PAT. OFFICE

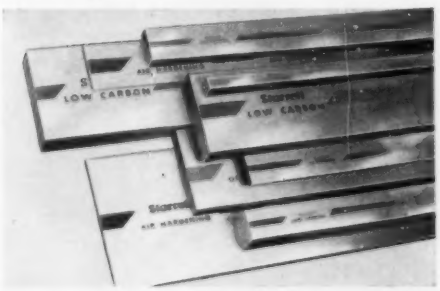
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world's largest producer of Subland Drills



PRECISION MEASURING TOOLS — Micrometer Caliper Set No. 436E-RL, 0-12". Range illustrated above

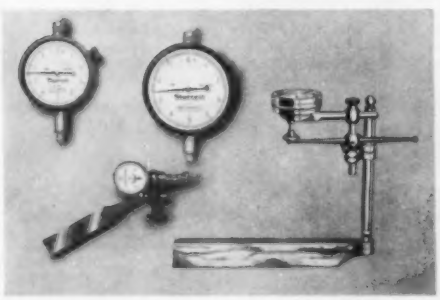
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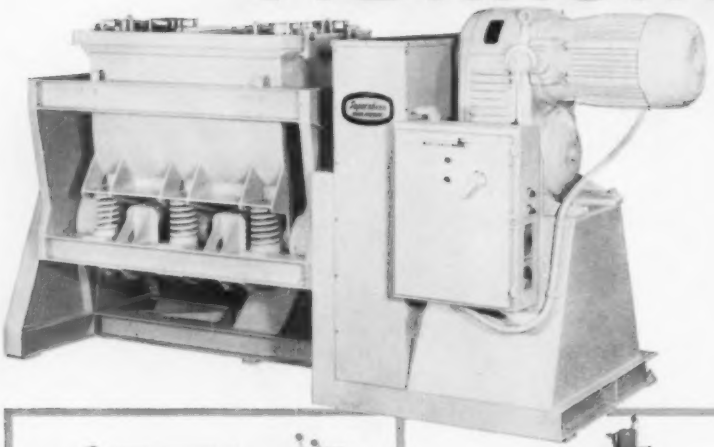


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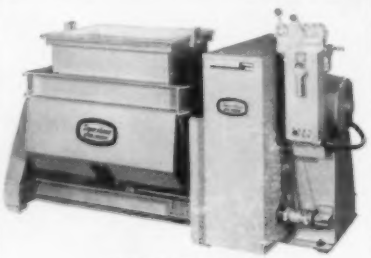
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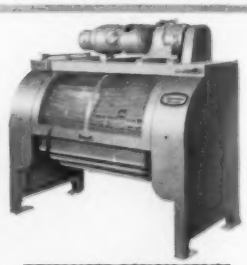


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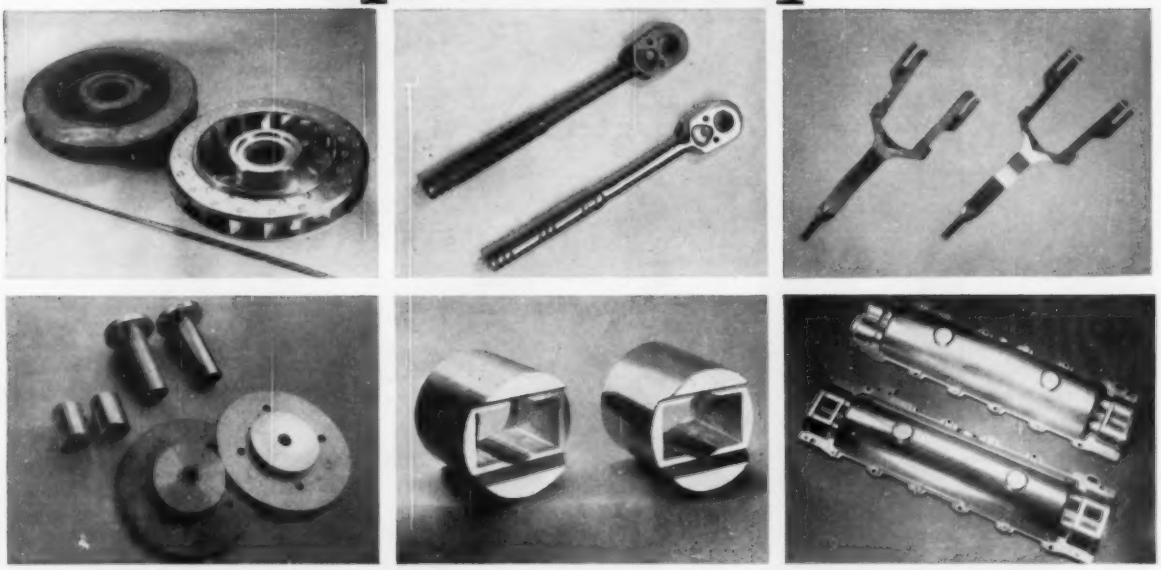
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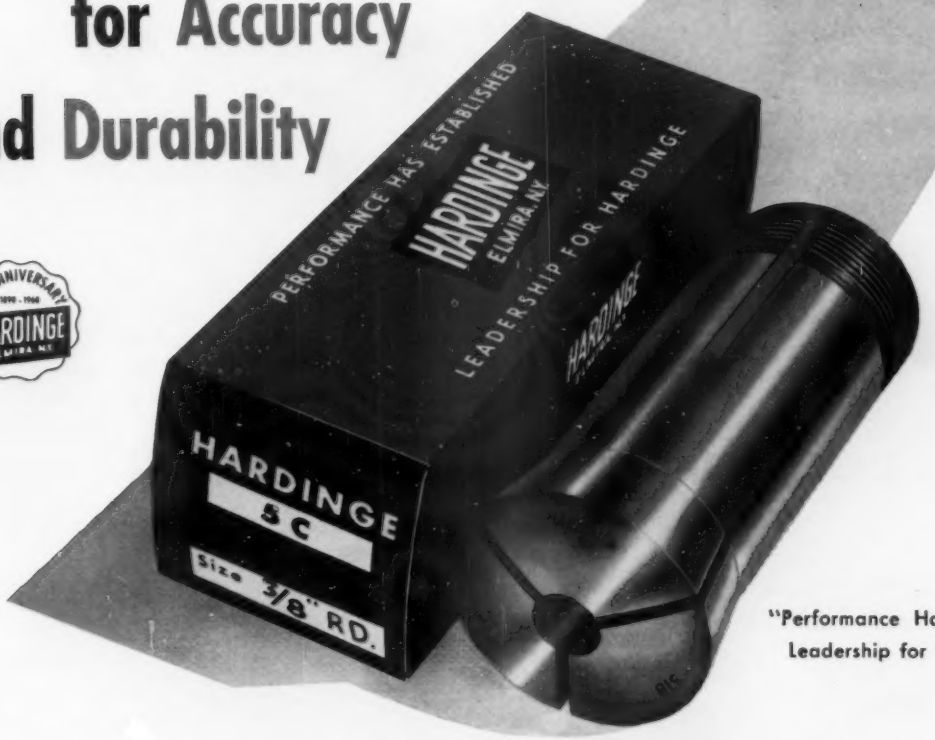
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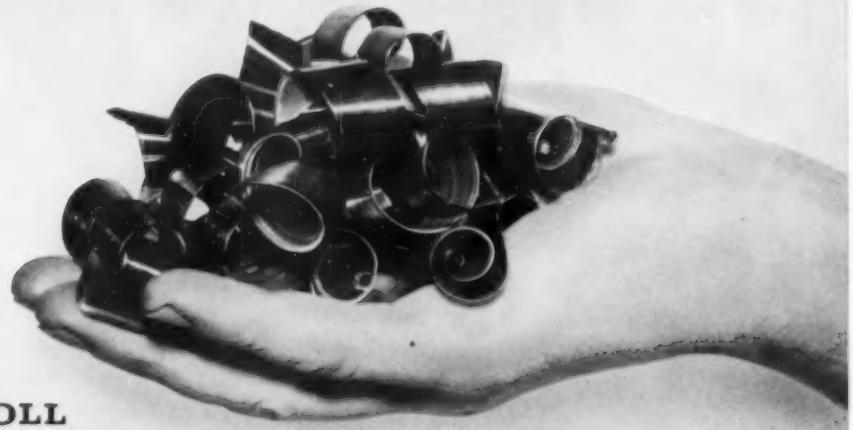
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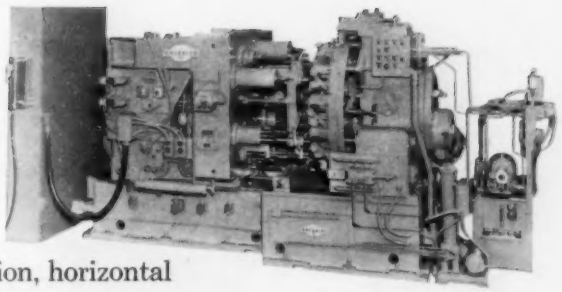
—because the cutter used to produce the more costly chips was not the right one for the work or for the machine on which it was used. It was a good cutter but not as good as it could have been. It's as simple as that.

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MILLING MACHINE COMPANY **CUTTER DIVISION** ROCKFORD, ILLINOIS

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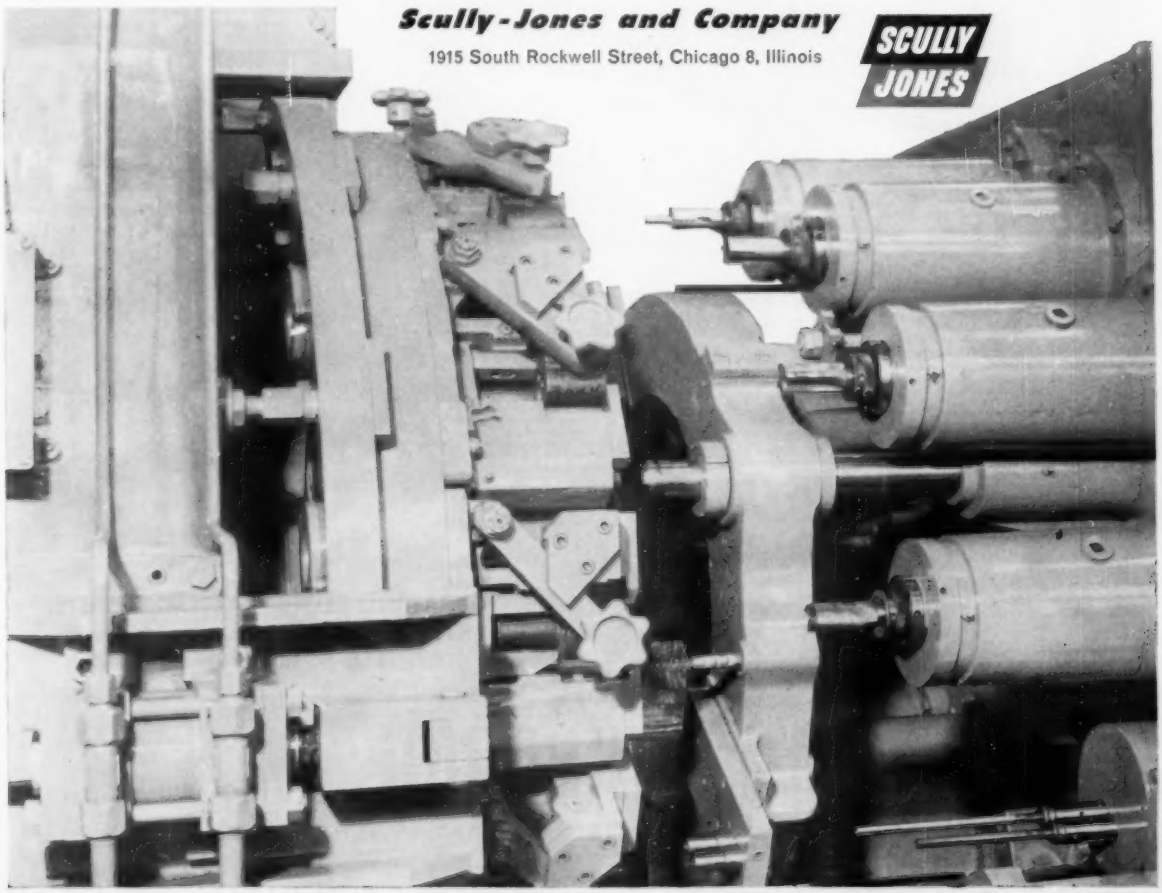


invested in multiple-spindle machines often is controlled by *tooling*. Greenlee engineers recognize this — specified quick-change, pre-set tooling as original equipment on this 12-station, horizontal indexing machine. It operates at close to 100% efficiency, drilling, chamfering, boring, and reaming pump bodies at 97 per hour. Cycle time per piece is 37.2 seconds. Depth of bore is held to ± .001", ream hole size to ± .0005". Scully-Jones "Better-Hold" chucks speed tool changes and provide a rigid, concentric drive for the boring tools (not piloted). Tools are preset outside the machine. Patented "Lock-and-Eject" nut on end of chuck turns on ball bearings. The operator just twists it to quickly unseat the tool. Opposite rotation produces a powerful, self-centering fit that assures high accuracy and long tool life. Ask your Scully-Jones distributor or representative for details.

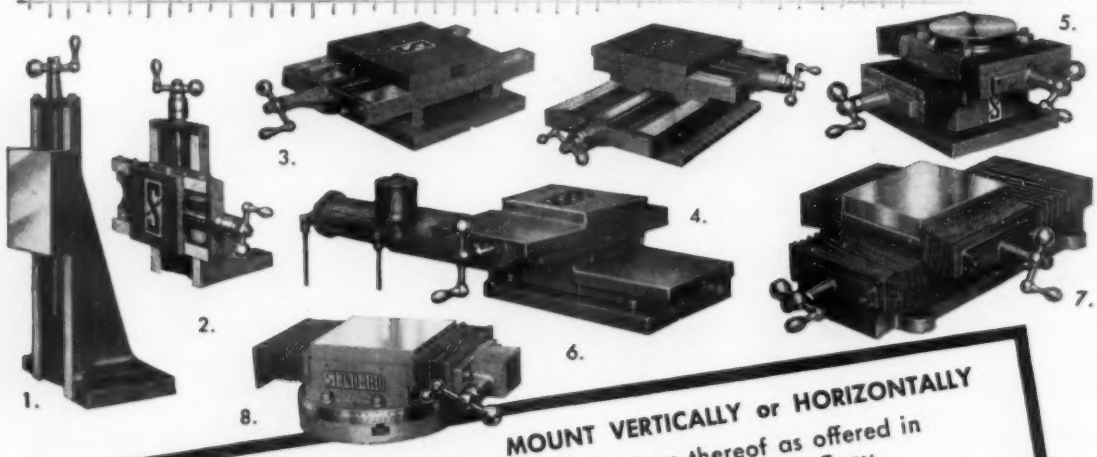


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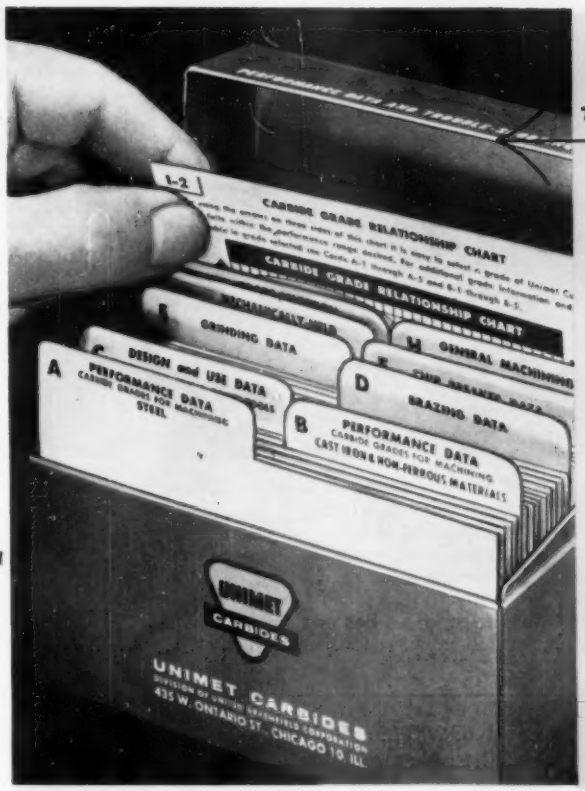
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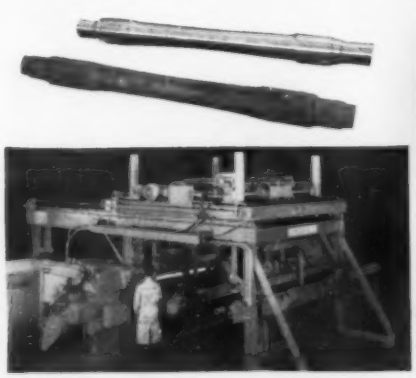
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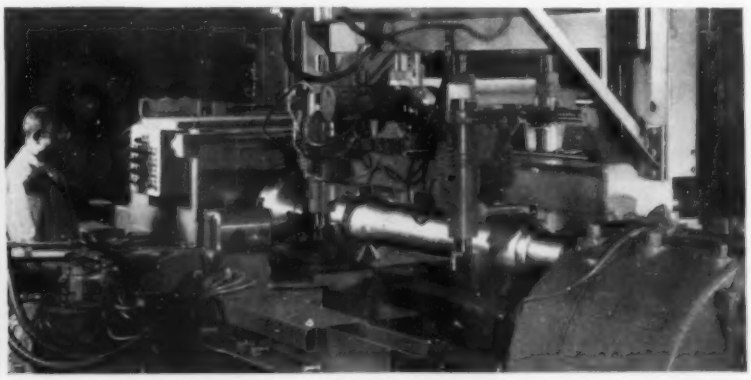
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TRACER TURNING *300-hp tracer lathe automatically loads, turns, and unloads 1800 lb. locomotive axle forgings*





Over 400 lb. of stock is removed from 1800 lb. locomotive axle forgings in an 11 minute cycle on this 300 hp Sundstrand tracer lathe. Parts are loaded, tracer turned and unloaded in a completely automatic cycle. Forgings range from 4 to 12 inches in diameter and 6 to 9 feet in length.

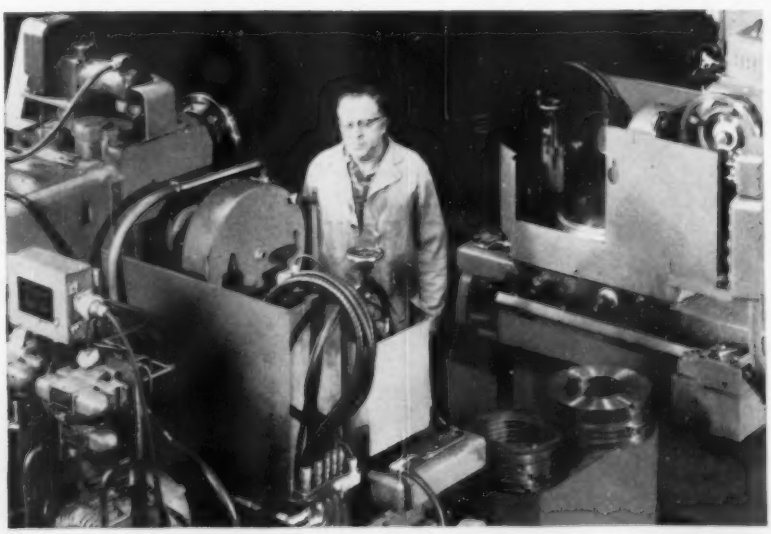
Ends are milled to length and centered prior to turning. With this new Sundstrand Lathe, production increase averages 4 to 5 times over previous method of turning these shafts.

The machine has one front and one rear tracer slide, each controlled from templates which are easily changed for varying sizes of workpieces.

A similar Sundstrand lathe is used for finish turning the axles.

For details on Sundstrand tracer lathes, ask for Bulletin T-721.

ROTARY SURFACE GRINDING *Operator runs two machines to ruff and finish grind 14″ clutch plates at 45 per hour.*

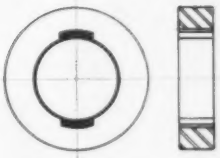


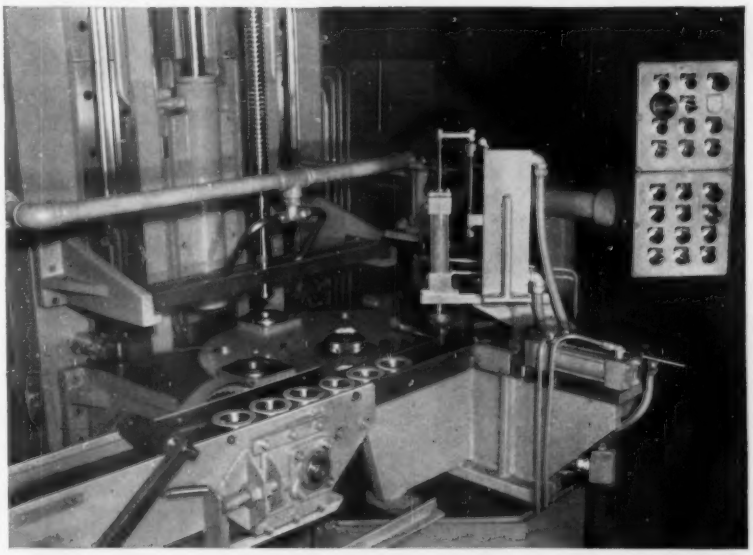
These two 20 hp Sundstrand-Arter grinders have the rigidity and power necessary for heavy cuts and fast stock removal. They ruff and finish grind clutch plates to an over-all flatness of .001″, total indicator reading — repeatability within ± .0005″. Required finish of 30 to 40 microinches is easily held; but finer finish is obtainable with these machines. Stock removal is from .009″ to .012″ per side.

The entire cycle is automatic except for load and unload, including fast feed for heavy stock removal with automatic change to slow speed for fine finish. When one side is finished on the first machine, the operator simply turns it over and positions it on the magnetic chuck of the second machine. Production is 45 pieces per hour per side per machine at 85% efficiency. *Ask for Bulletin G-721.*

INTERNAL BROACHING

Fully automatic cycle loads, broaches, and unloads gear blanks three at a time





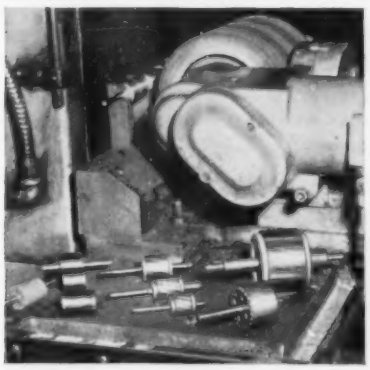
The ID and two splines are automatically broached at a rate of 350 per hour (at 100% efficiency) by this Sundstrand-American machine.

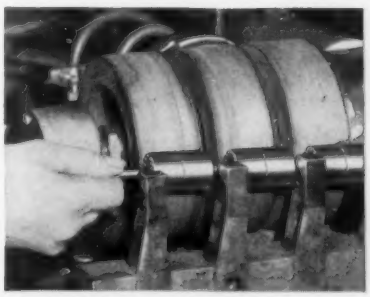
Parts are fed into a fixture by belt conveyor, stacked three high, indexed, machined, and ejected onto the outgoing conveyor. The entire cycle is fully automatic. While parts are being loaded at one station, other parts are being broached. The machine also is equipped with automatic chip conveyor.

Bulletin No. B-721 *describes Sundstrand-American vertical and horizontal broaching machines.*

CYLINDRICAL BELT GRINDING

Production increased 500%; equipment cost cut 60%; floor space reduced 50%





Use of a special cylindrical grinding fixture mounted on the automatic in-feed table of this Sundstrand-Engelberg belt grinder provides grinding of electric motor rotors to a tolerance of .0002 to .0004″. Diameters are accurate to ±.0005″. Rotors without shaft are mounted on an arbor, as shown at right. Rotors with shafts, at left, are held on their own shafts. A production cycle takes as little as 12 seconds.

The savings listed above are not uncommon wherever Sundstrand-Engelberg precision abrasive belt grinders can be employed to replace other classes of equipment. Literature available upon request.

THE CASE STUDIES LISTED HERE ARE TYPICAL OF THE RESULTS ACHIEVED THROUGH SUNDSTRAND'S "ENGINEERED PRODUCTION" SERVICE WHICH ANALYZES YOUR MACHINING REQUIREMENTS AND ESTABLISHES THE METHODS AND EQUIPMENT WHICH WILL GIVE YOU THE GREATEST OVER-ALL PRODUCTION ECONOMIES.

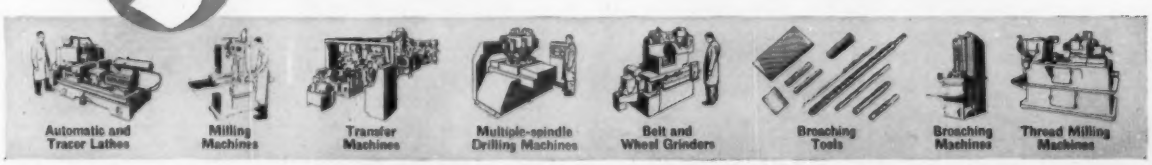
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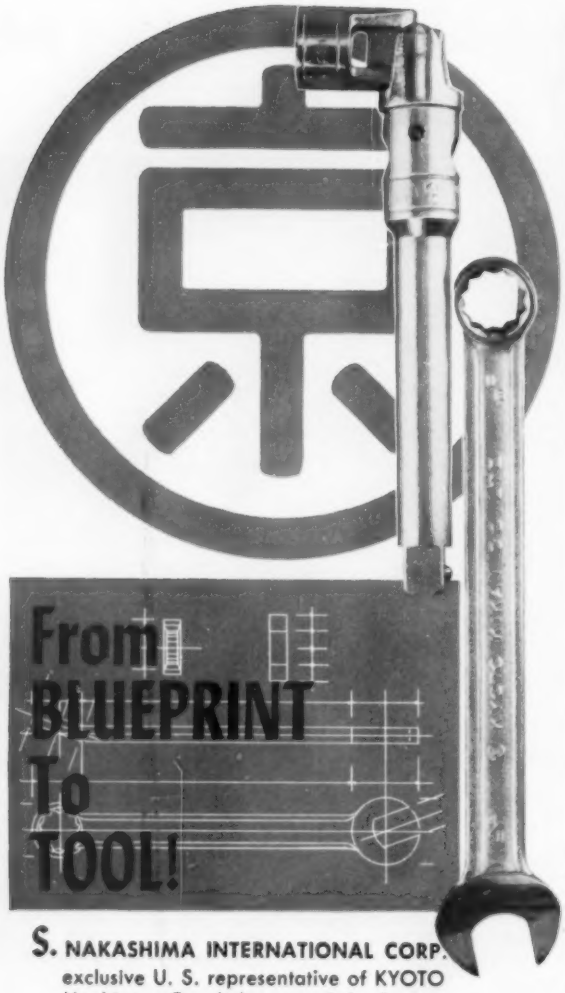


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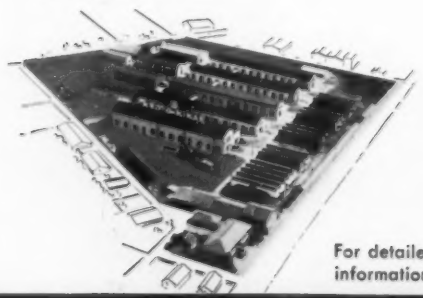
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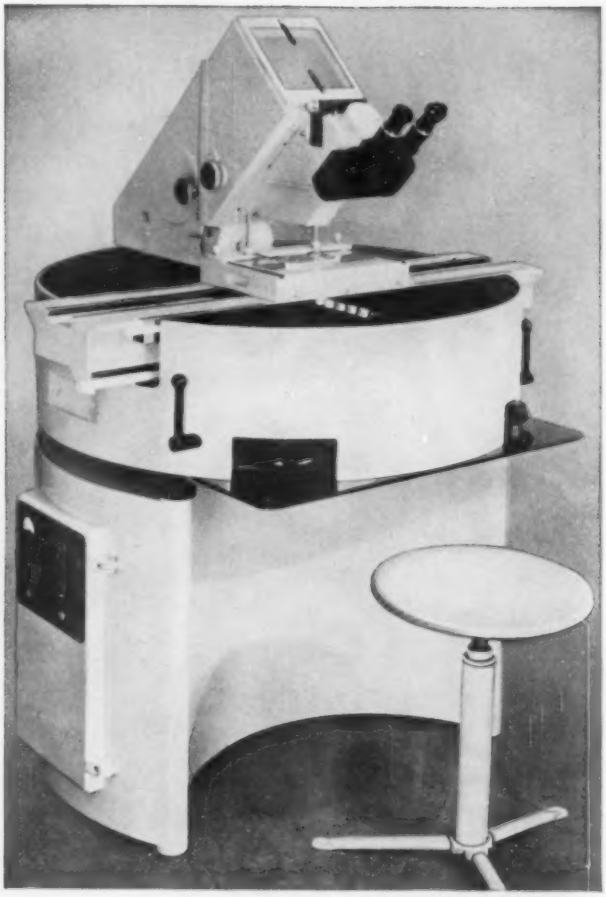
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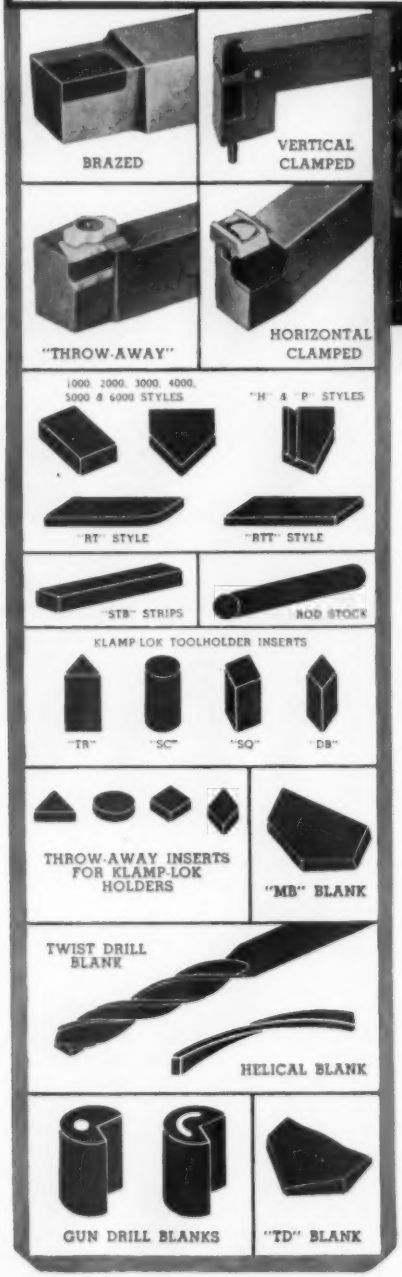
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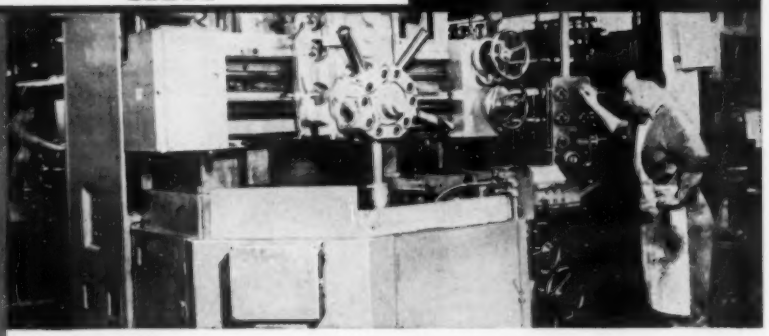
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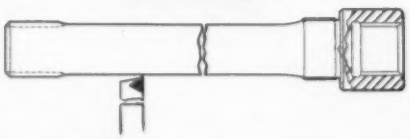
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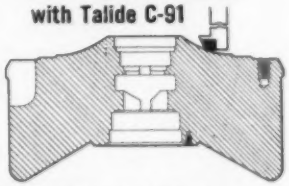


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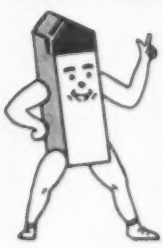
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600 Wheels machined with Talide C-91



Main drive shaft 15/16" dia. x 16-15/32" long	**Part**	Rear tractor wheel 15" dia. x 7-19/32" thick
H.R. A-8640 steel 285-321 Brinell	**Material**	Hi-nickel cast iron SAE111
Turn O.D. of Shaft	**Operation**	Face outer edge of wheel hub, 1/2" wide cut
Carbo-matic	**Machine**	Bullard
#TN-163P3 Talide Disposable insert 1/2" I.C. x 3/16" thick, negative angle, 3/64" corner radii, Grade S-92	**Tools**	#GL-20 brazed tool, off-set style, 1-1/4" x 1-1/4" x 8" shank size, Grade C-91
1/16"	**Depth of Cut**	1/8" to 1/2"
.009	**Feed**	.033
115	**Speed (S.F.M.)**	210
450	**(R.P.M.)**	39
Soluble Oil	**Coolant**	dry
Talide Grade S-92	**Results**	Talide Grade C-91
Machined 18 shafts per grind. Next best premium grade produced only 12 shafts.		Machined 600 wheels per grind compared to 400 for next best premium grade.

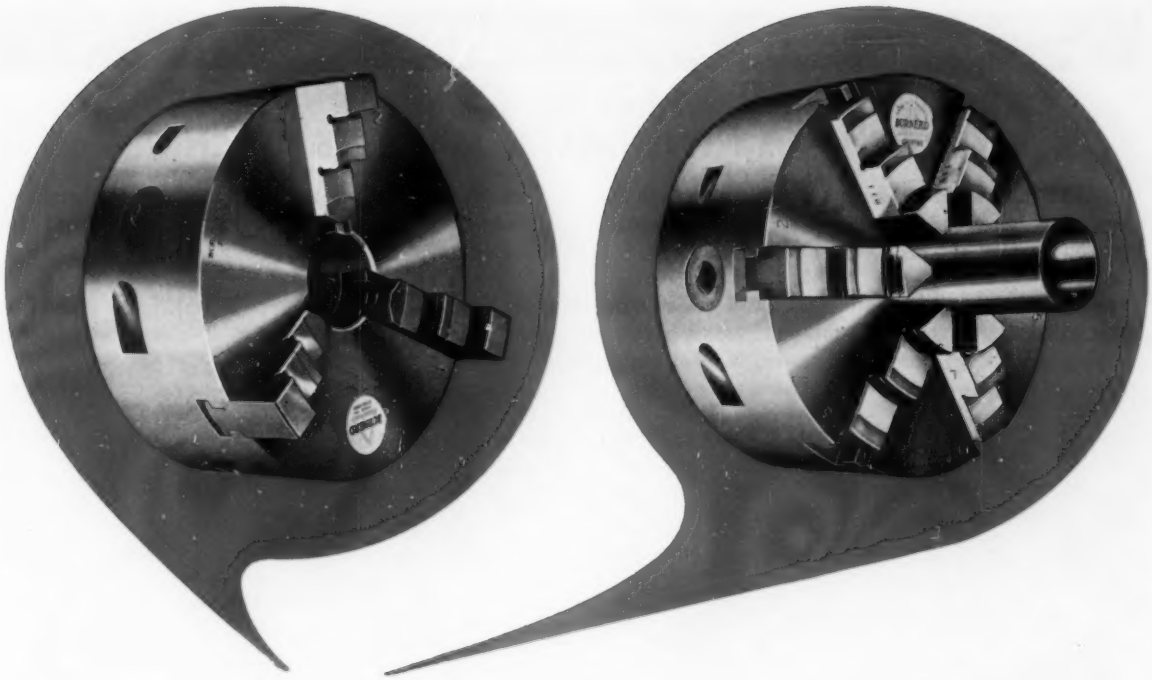


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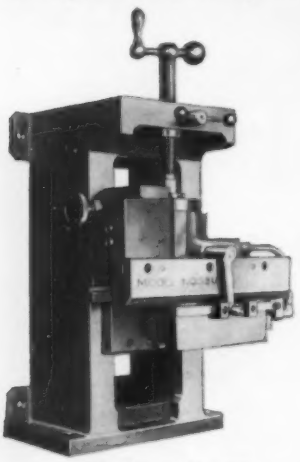
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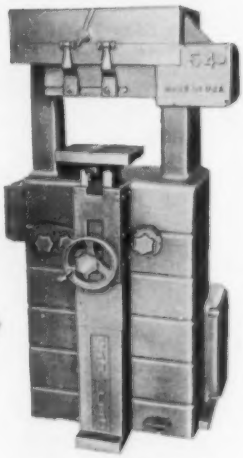
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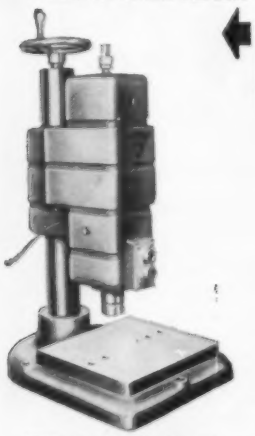
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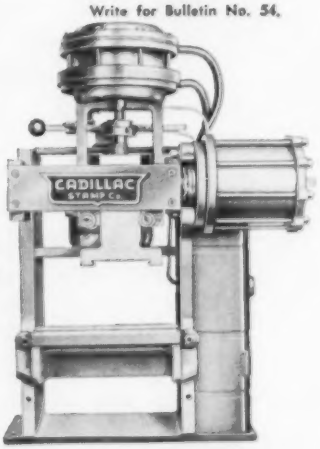
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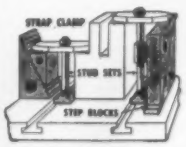


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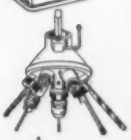
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JEMCO MACHINE TOOLS

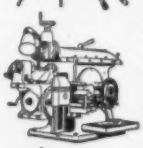


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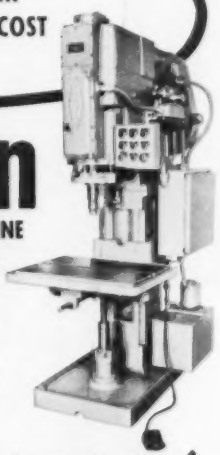
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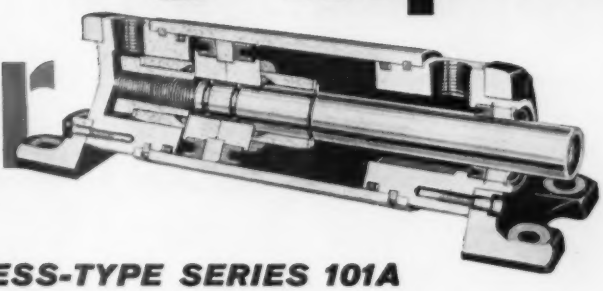
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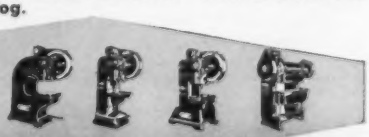
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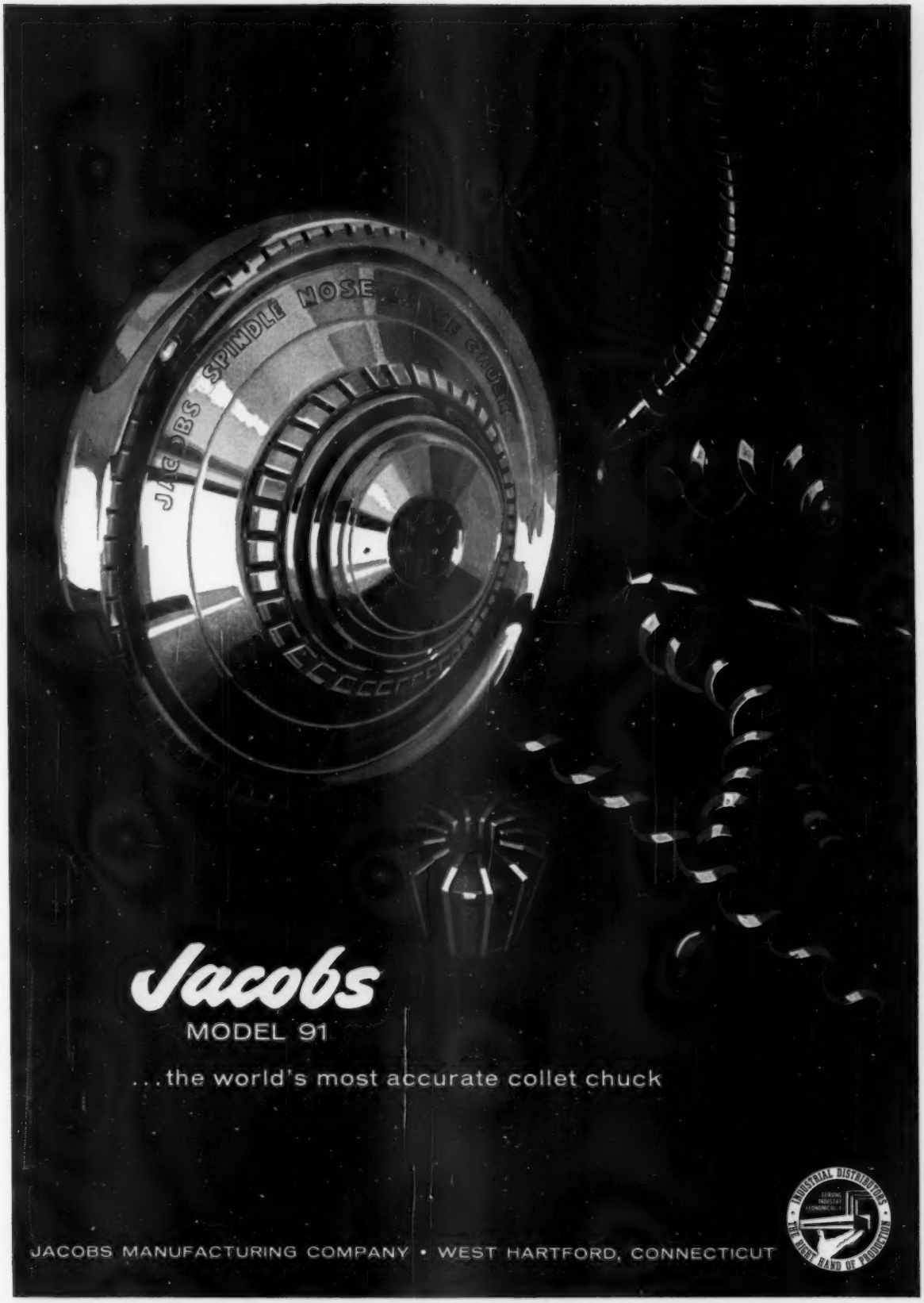
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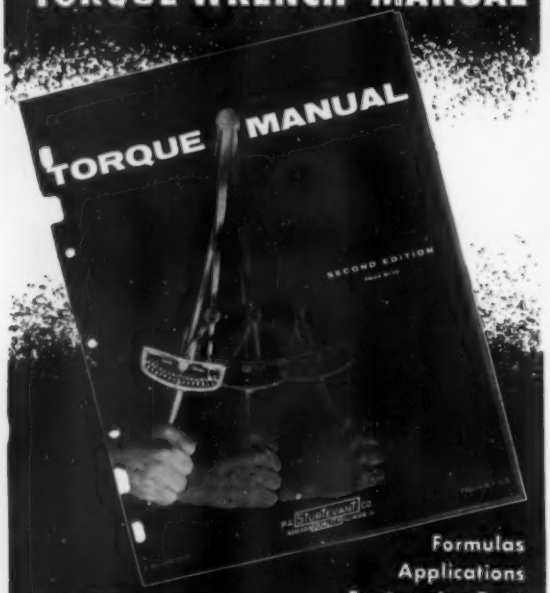
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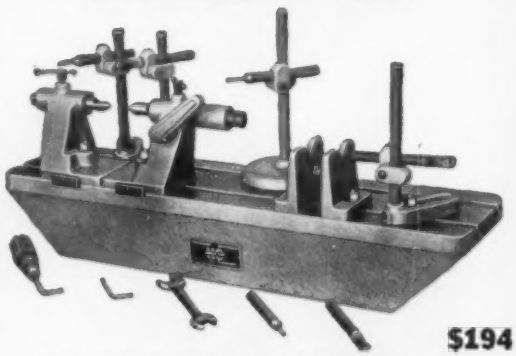
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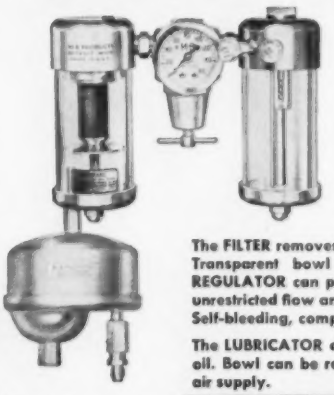
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3" hole through 3" plate took just 52 seconds. Note perfectly formed chips that indicate continuous, vibration-free cutting even while operating at .100" rate of feed. Demonstration took place at Machine Tool Show.

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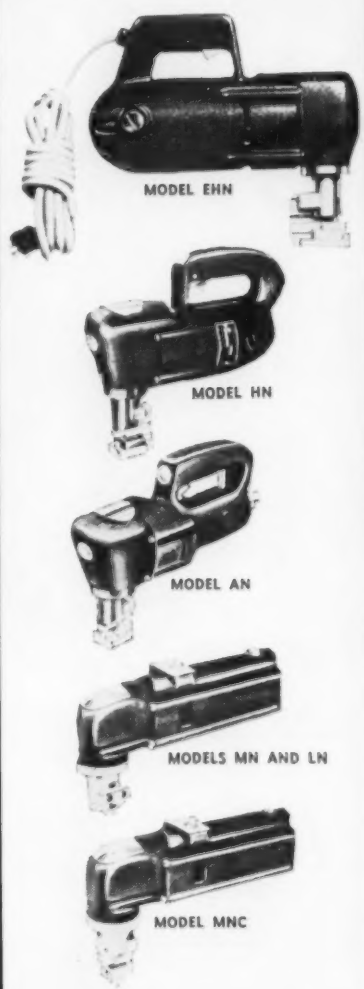
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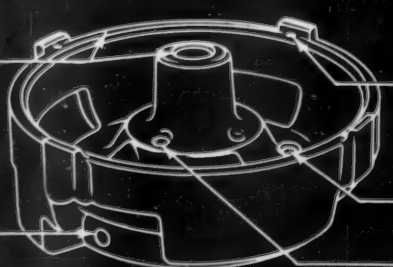
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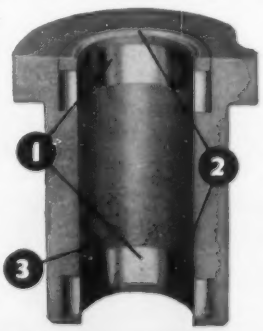
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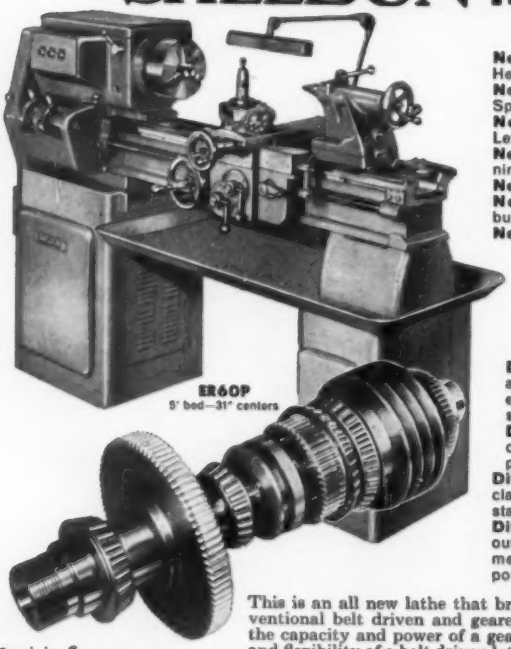
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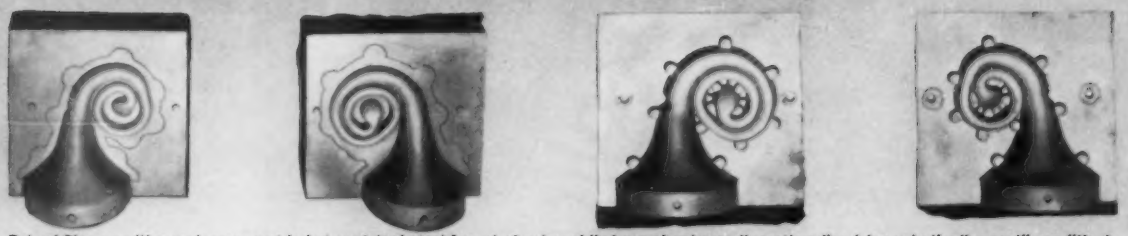
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Higher Production With Fewer Rejects—The absence of insert flash traps, tool marks, and increased resistance to peening results in smooth operation, less down time, less die and ejector pin maintenance and fewer rejects. It has been found that the increase in the total number of good castings per day can be as high as 25%.

Better Finish—Producing a single Shaw casting to replace a group of small inserts eliminates hot spots and blistering...produces better thermal balance, results in finer plateable finish, sounder diecastings.

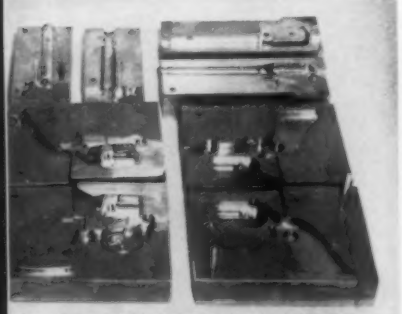
Rapid Replacement of Damaged, Worn Cavities, or for Engineering Changes—Damaged die components and sudden engineering changes can play havoc with production and delivery schedules. Keeping patterns on hand, Shaw replacement castings are obtained overnight.

Less Deformation in Heat Treatment—Since the fine-grained cast structure of the Shaw-cast die component has no directional grain, it is not subject to the stresses set up by machining a forged bar. There is less movement during heat treatment and little fitting is required in the heat treated stage. In the event frequent annealing and reheat treatment for welding or other modification becomes necessary, users have found that the Shaw Cast die component (with its non-directional isotropic grain structure) gives less distortion.

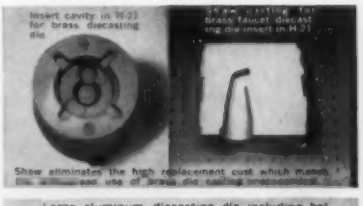
For a copy of the 56 page brochure describing the Shaw Process, write Dept. T-2

Shaw Process Development Corp., Division of British Industries Corporation, Port Washington, New York.

SHAW PROCESS



Set of toy pistol dies for zinc in H-13. The first shot parts mated with such accuracy that no die rework was necessary.



Insert cavity in H-21 for brass diecasting die.

Shaw casting for brass faucet diecasting die insert in H-21.

Shaw eliminates the high replacement cost which means the economical use of brass die casting impressions.

Large aluminum diecasting die including bolster block. Castings weighed over 1000 lbs. as cast. Despite complex parting lines, all die sinking was eliminated.



Other applications of the SHAW PROCESS

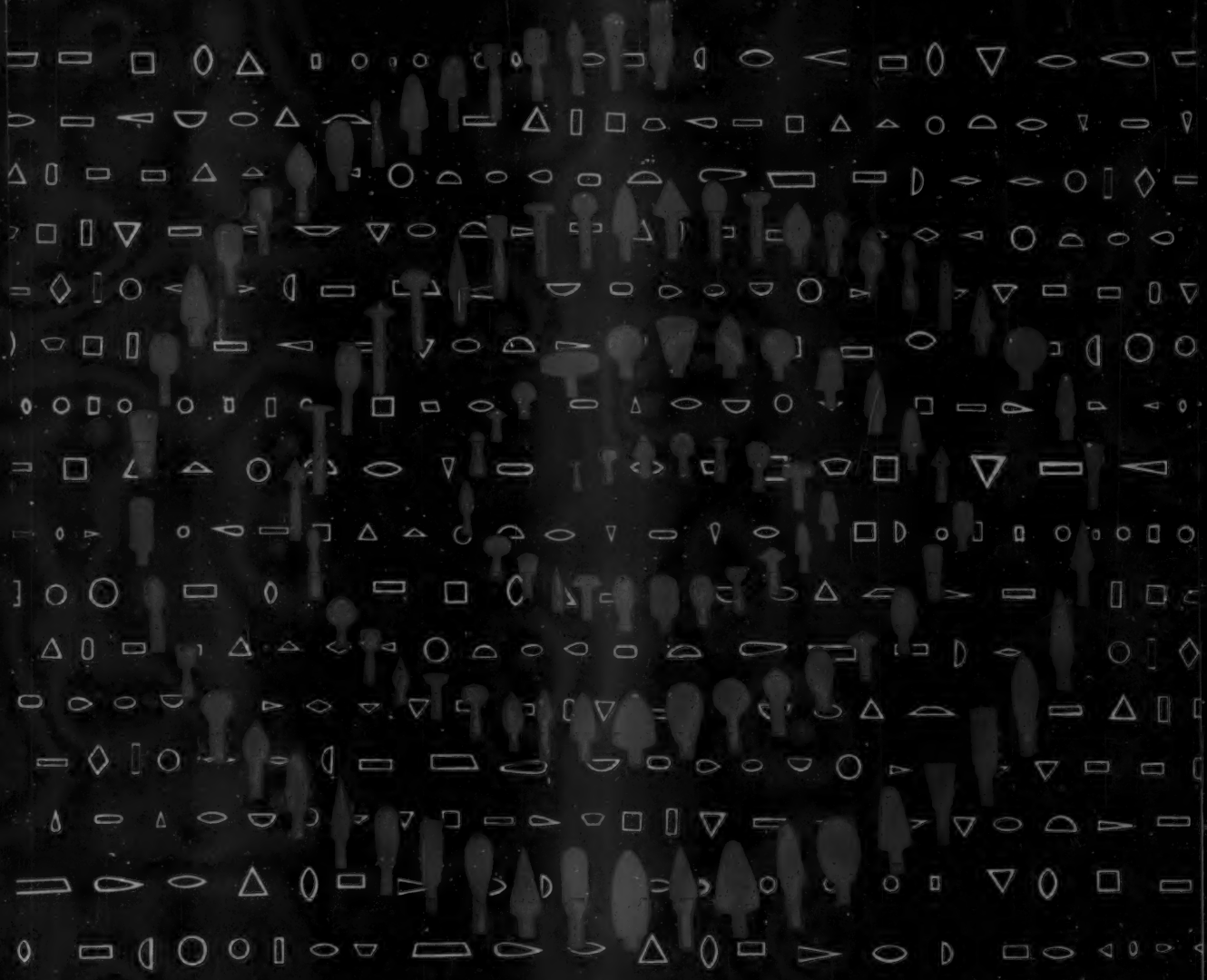


SHAW PROCESS

Division of British Industries Corp., Port Washington, New York.

You are cordially invited to see the Shaw Process, on display at Booth 513, Detroit Artillery Armory (Nov. 8-11) and Booth 344, Los Angeles Sports Arena (Nov. 14-18).

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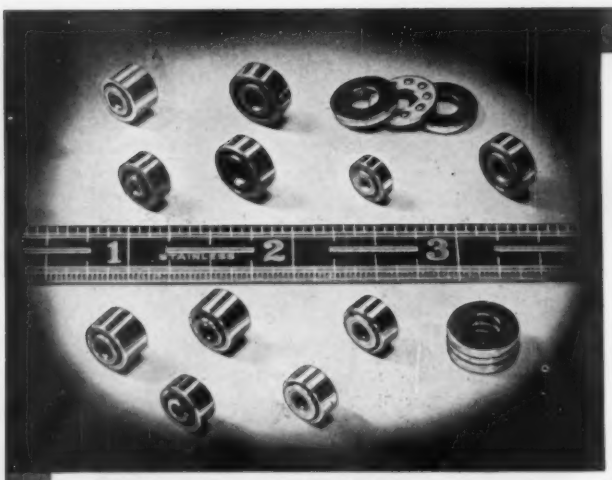
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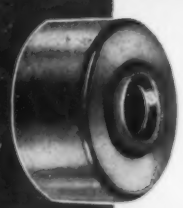
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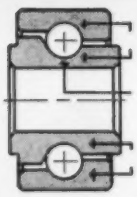
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ACTUAL O.D. 9/16"

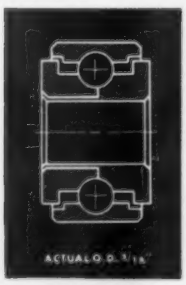


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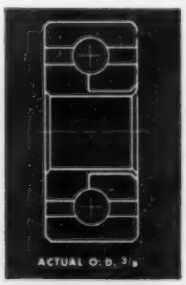
*Unibal FEATURES

No. 6035-1 — Rear support bearing for print wheel carriage on electronic potentiometer.



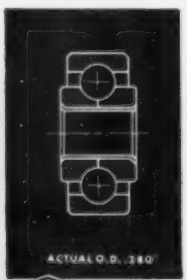
ACTUAL O.D. 1/16"

No. 6034-1 — Idler clutch bearing on 8 mm motion picture projector.

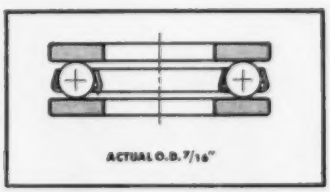


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This experimental and analytical approach is achieving progress toward jog-free, stably distributed, and suitably thick oil films required in high-precision bearings. It is a further example of the critical and advanced research General Motors carries out in seeking "more and better things for more people."

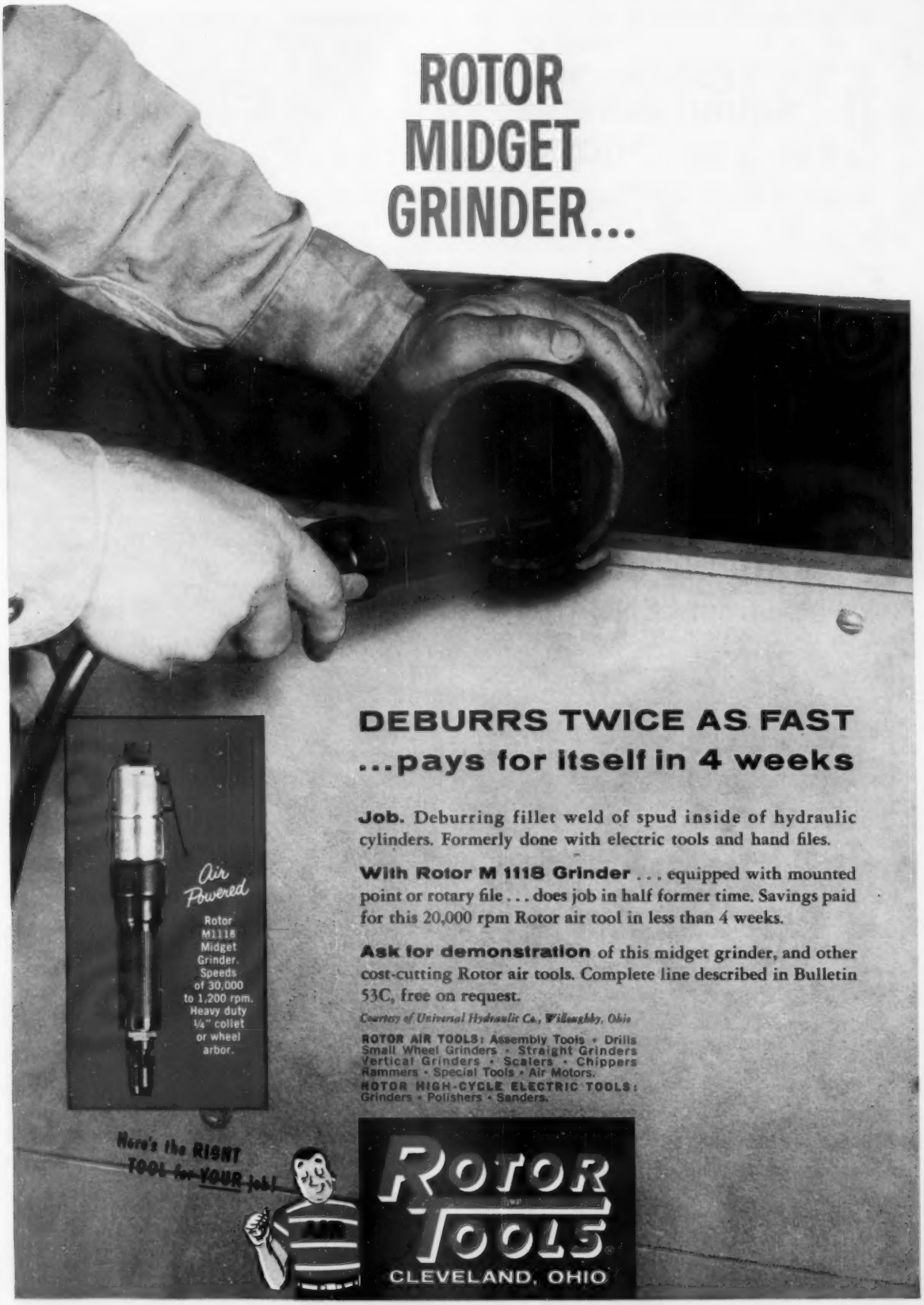
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Warren, Michigan

The fluoresced streaks show the disturbed "wake" of the lubricating film during bearing operation. The active part of the film, too thin to fluoresce visibly, averages ten-millionths of an inch in thickness.

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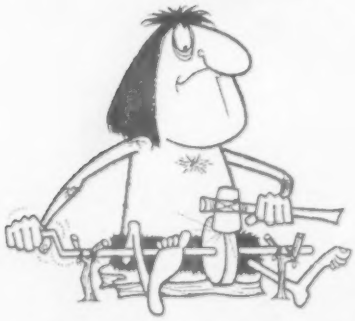
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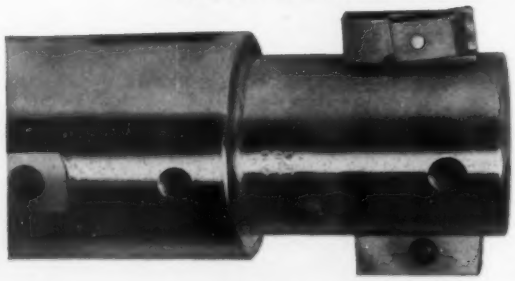
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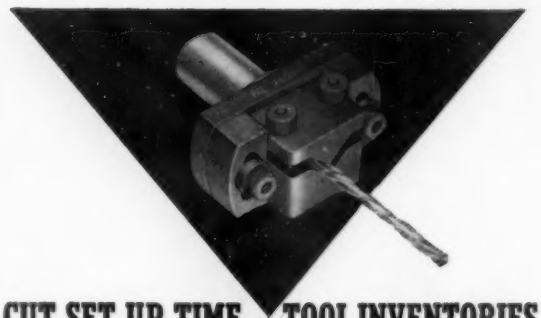
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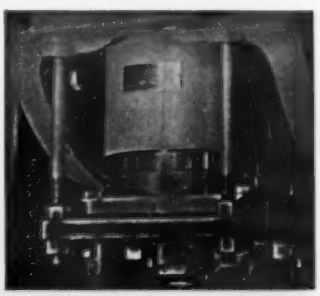
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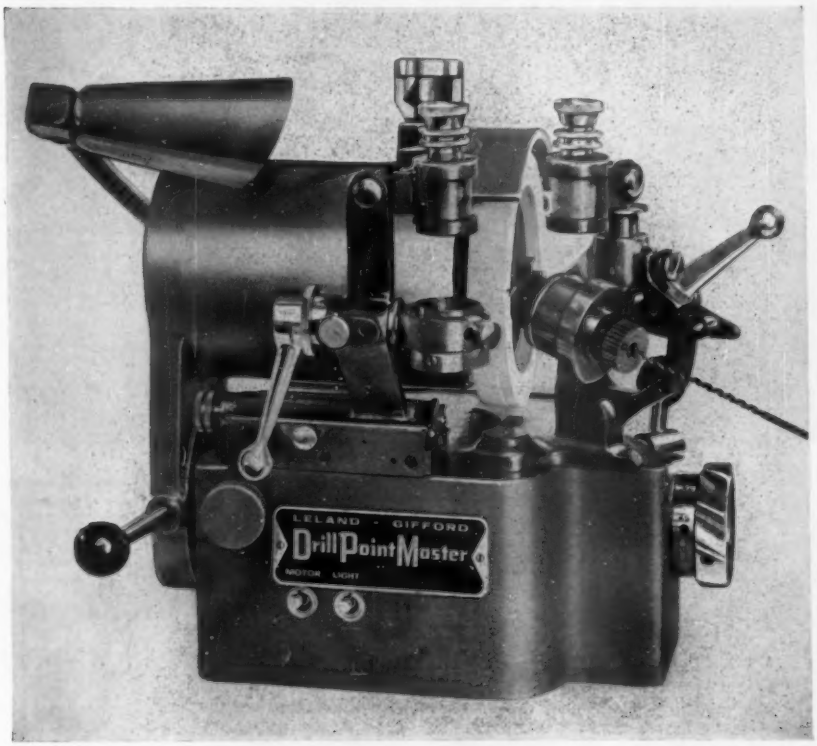
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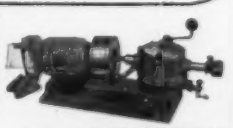


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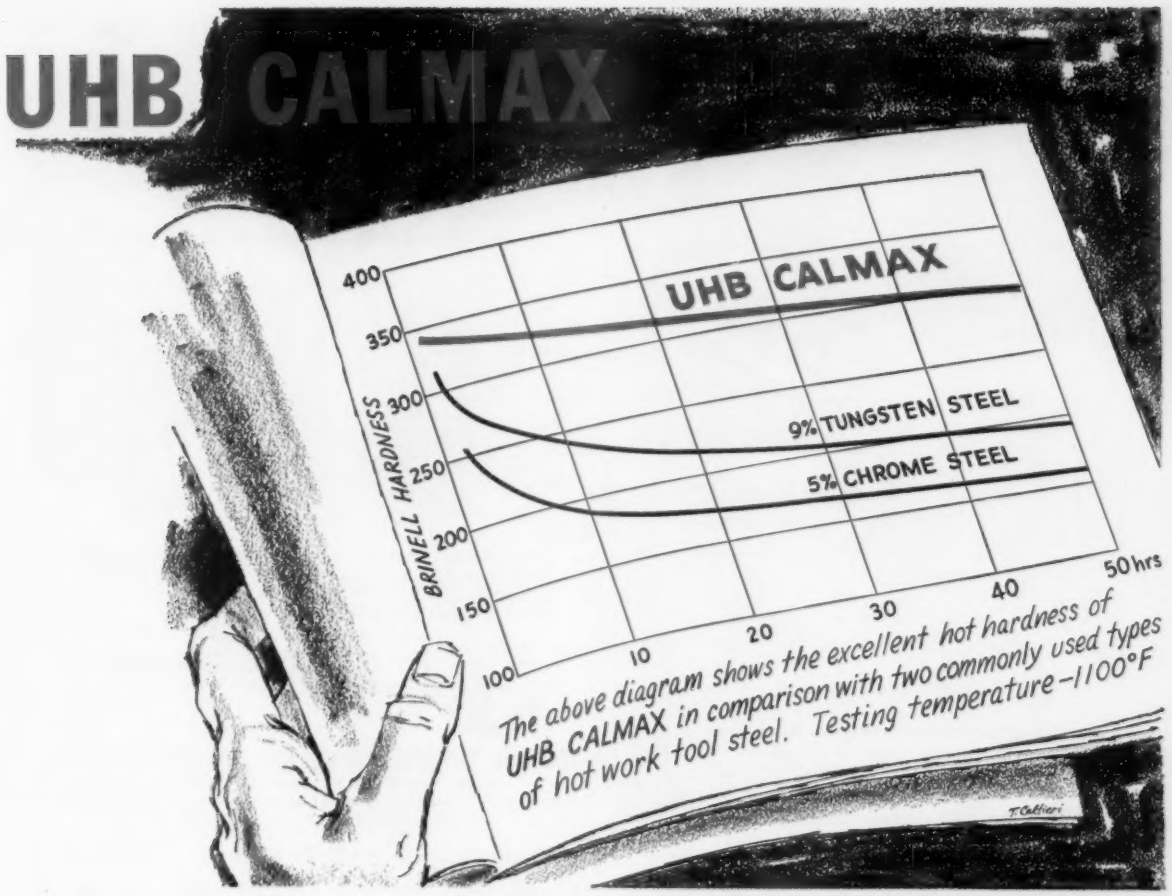


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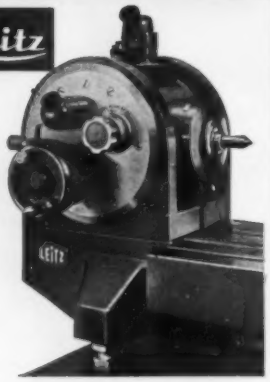
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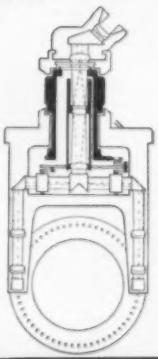
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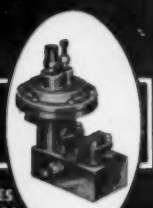
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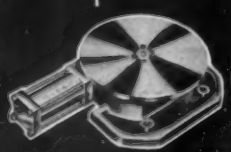
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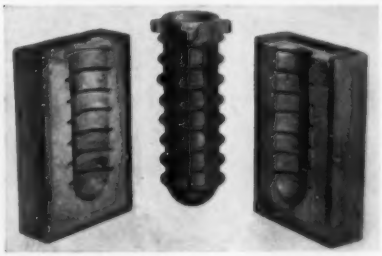
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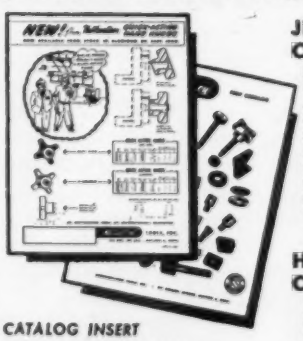


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with this NEW Cadillac Bore Set PLA-CHEK



You can set:

DIAL BORE GAGES
INSIDE MICROMETERS
TELESCOPING GAGES
INTERNAL CYLINDER GAGES

. . . much faster than you can read this page!

It's true! Time-saving is one of the big features of this new Cadillac Bore Set PLA-CHEK. Guaranteed accuracy is another! Designed especially to save time, money and to provide extreme accuracy in the setting and checking of Dial Bore Gages, Inside Micrometers, Telescoping Gages and Internal Cylinder Gages, this new PLA-CHEK is guaranteed to .000050". No gage blocks need be used and, in most cases, ring gage setting masters are not necessary. This new PLA-CHEK is the result of over 16 years' experience in the building of high-precision PLA-CHEK Gages. It is designed for easy portability on the job so that it may be used either on the surface plate or at the machine. Write, wire or telephone TODAY for prices and additional information.

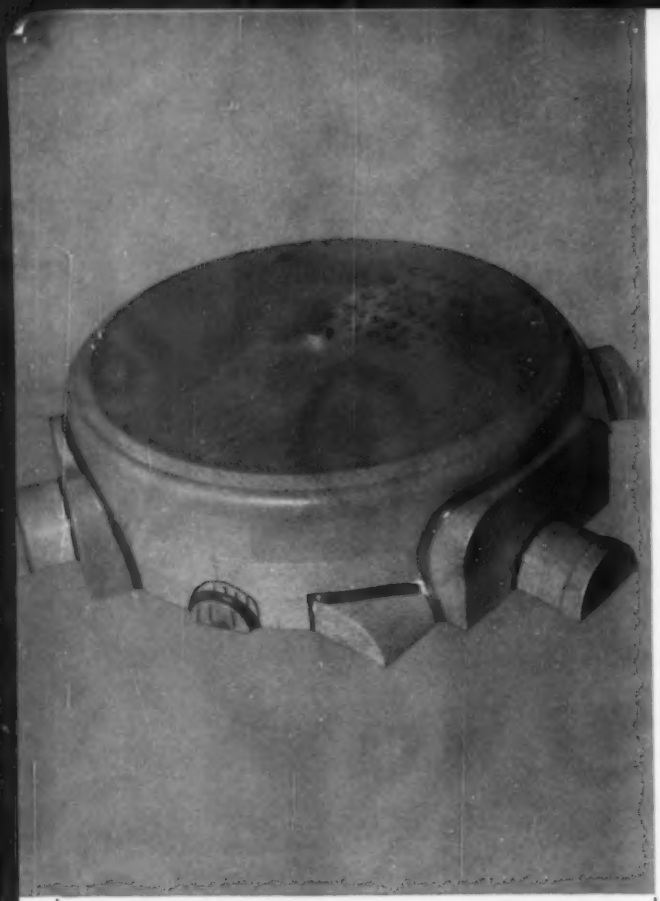


Use it as a regular PLA-CHEK, too!

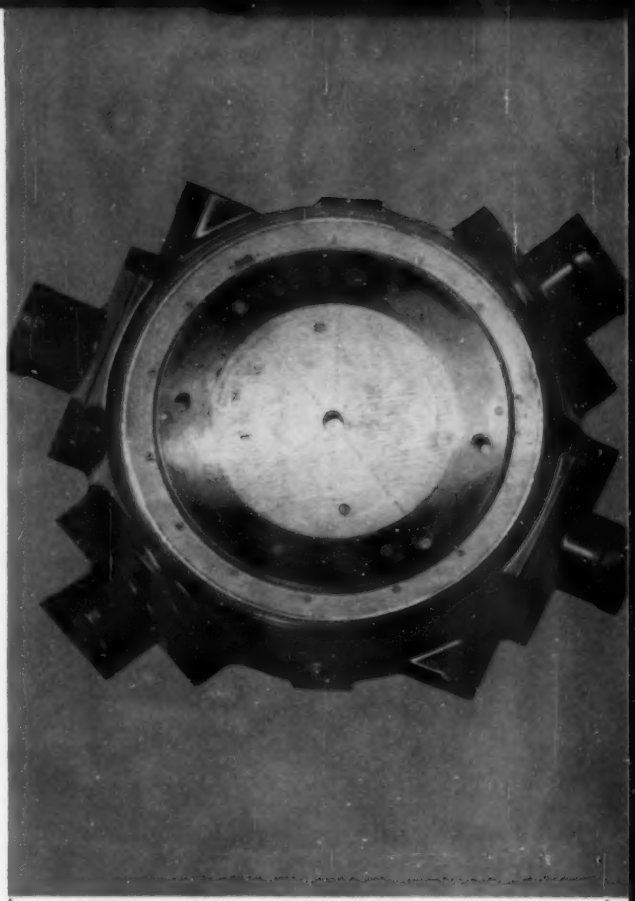
You get a two-for-one value with the new Cadillac Bore Set PLA-CHEK. It is also a regular, 13" self-contained PLA-CHEK Gage for use on all checking and inspection jobs where extreme accuracy is important and where speed is essential. The Bore Gage Set Stock assembly may be removed or it may be used as a reverse checking plate. Other PLA-CHEKS include the 6", 12", 18", 24", 30" and 48" models.

Cadillac GAGE COMPANY

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This single wood master pattern, difficult and costly to precisely reproduce and change to meet various design modifications, was used to make . . .



The epoxy tooling compound was supplied by Rezolin, Inc., Detroit, Michigan.

This epoxy mold, which was easily altered four times to make new epoxy patterns.

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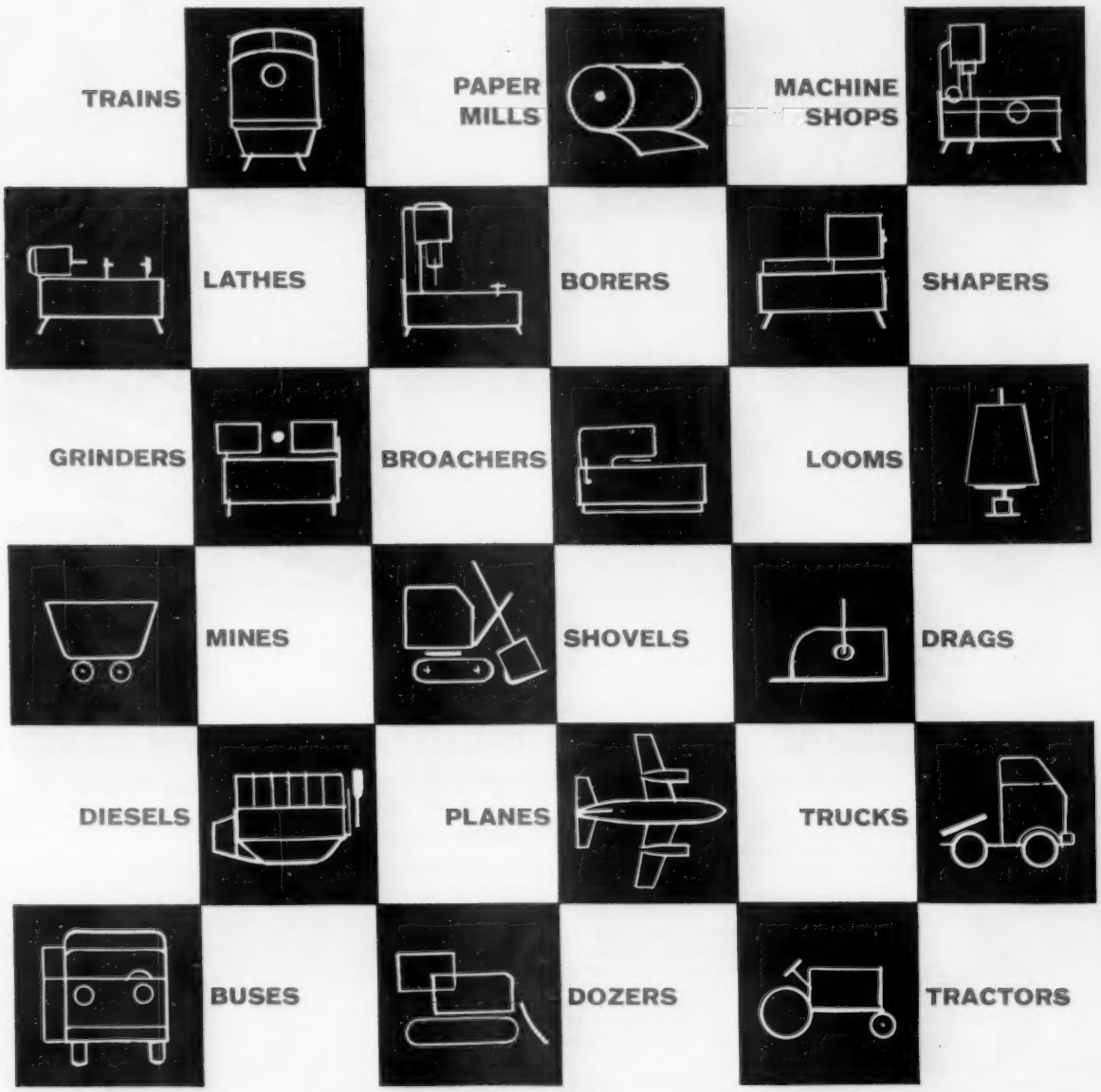
Further information on BAKELITE Brand epoxy resins for tooling is available from your Union Carbide Plastics representative, or write Dept. DX-141, Union Carbide Plastics Company, Division of Union Carbide Corporation, 270 Park Ave., N.Y. 17, N.Y. *In Canada:* Union Carbide Canada Limited, Toronto 12.

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of ferrous, non-ferrous, non-metallic solids and shapes



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manual or automatic

CUT-OFF MACHINE

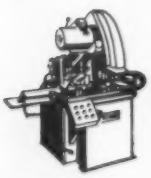
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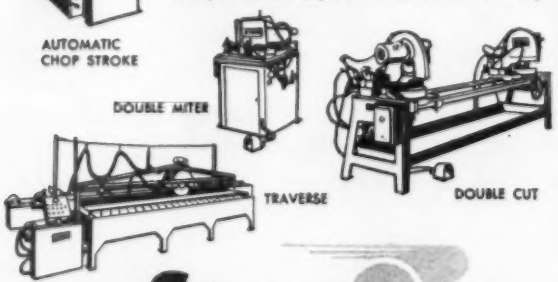
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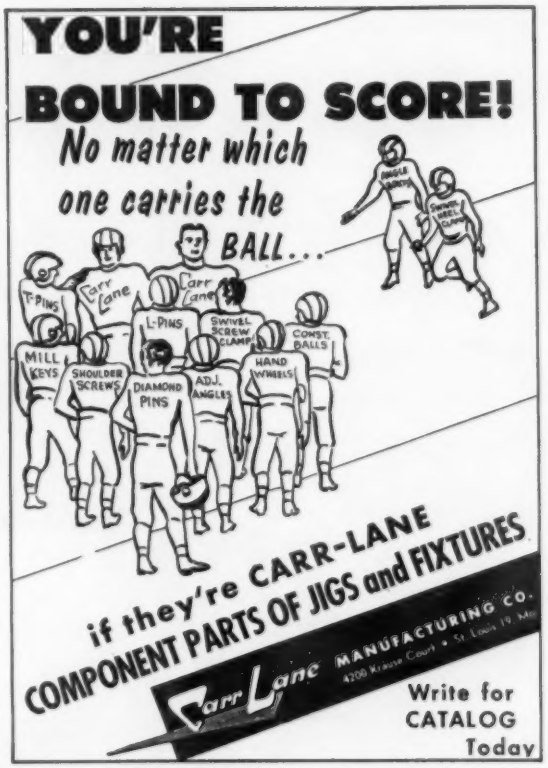


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What HORACE DREVER has to say about Lindberg heat treating equipment



Mr. Horace Drever, internationally prominent in the industrial heating field, is a Past-President of the Furnace Manufacturers Association and President of Drever Company, furnace manufacturers and commercial heat treaters.

QUOTE from Mr. Drever's unsolicited letter to Lindberg Engineering Company

"For the past three and one-half years, we have been operating one of your Type 243618 GVRT Furnaces along with a 500 CFH Lindberg Hyen generator in our commercial heat treating division. We are extremely pleased, not only with the fine quality of work turned out by this equipment but also its relatively trouble-free operation. As evidence of our complete satisfaction we have ordered another Lindberg Furnace of this type."



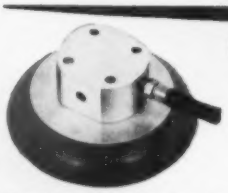
Lindberg Furnaces in operation at the Drever Company, Bethayres, Pennsylvania.

We are happy that Mr. Drever, a furnace manufacturer in his own right, originally chose Lindberg equipment for his heat treating plant and that its satisfactory service prompted an additional order. The second Lindberg Furnace is now in production at Drever Company, as the adjacent photo shows. Bless those satisfied customers! If you have a product or process in the metal or ceramic field requiring the application of heat you can depend on Lindberg's engineering and design know-how to provide exactly the right equipment to answer your need. Get in touch with your nearest Lindberg Field Representative (see classified phone book) or write direct to Lindberg Engineering Company, 2447 West Hubbard Street, Chicago 12, Illinois. Los Angeles plant: 11937 South Regentview Avenue, Downey, California. In Canada: Birlefco-Lindberg, Ltd., Toronto.

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heat for industry

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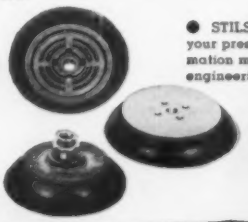
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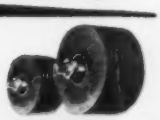


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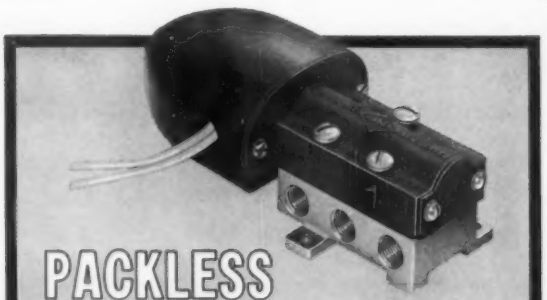
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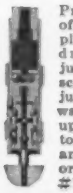
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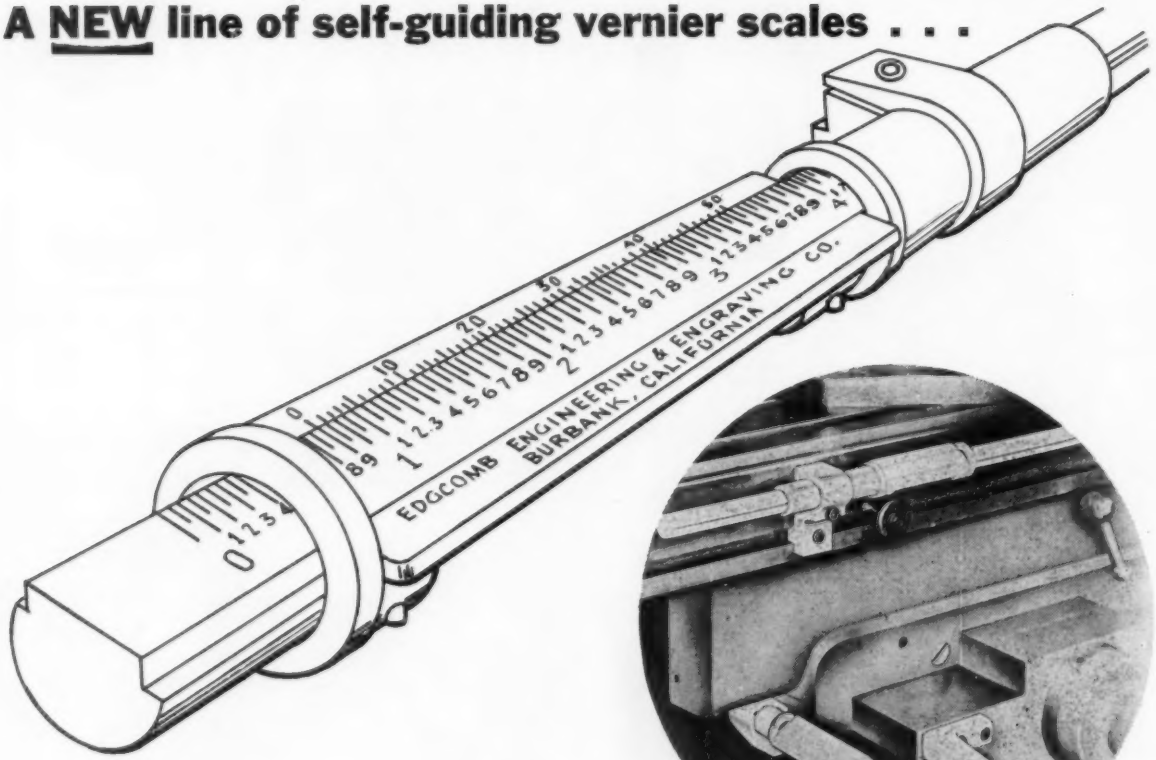
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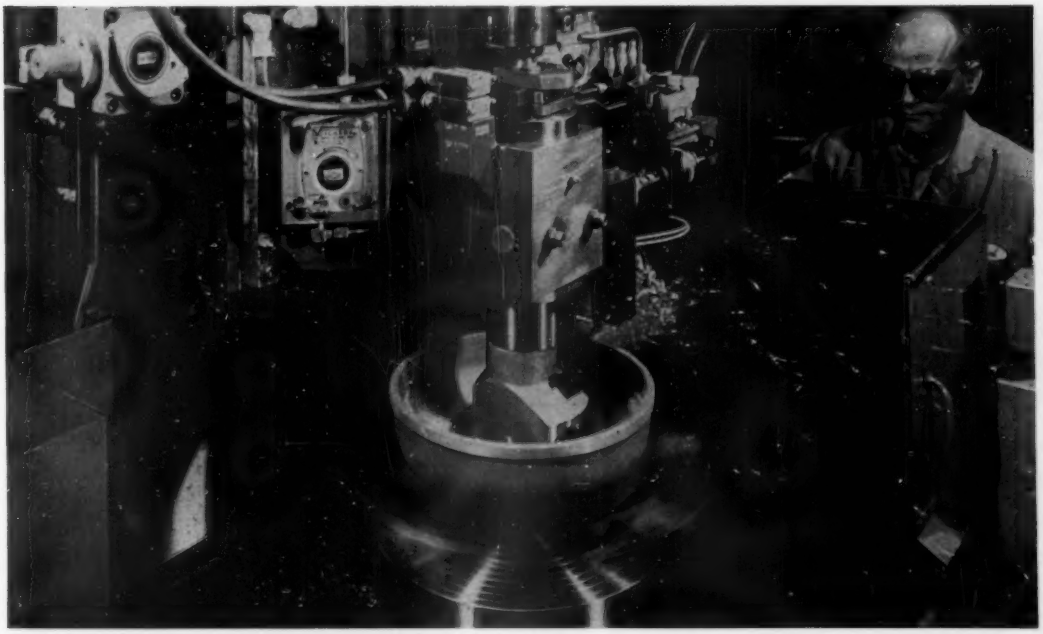
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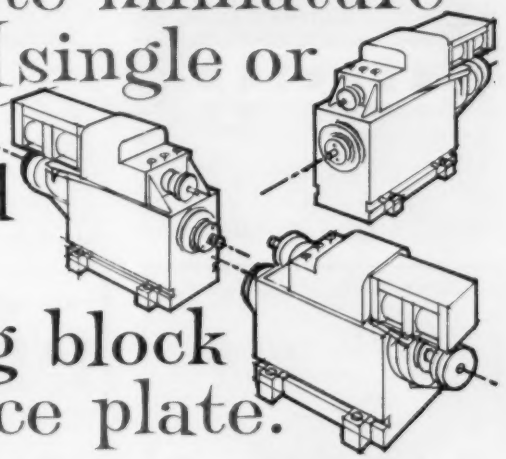
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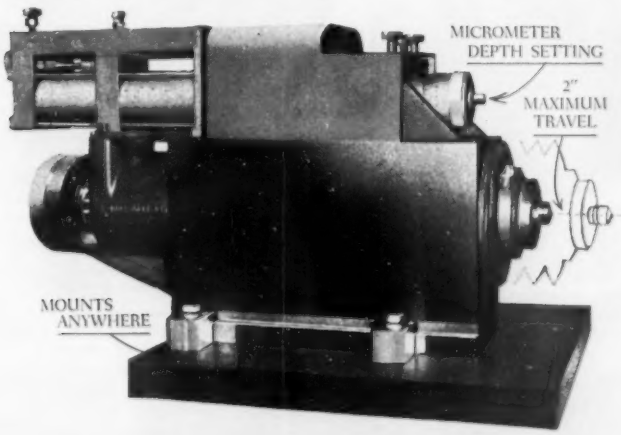
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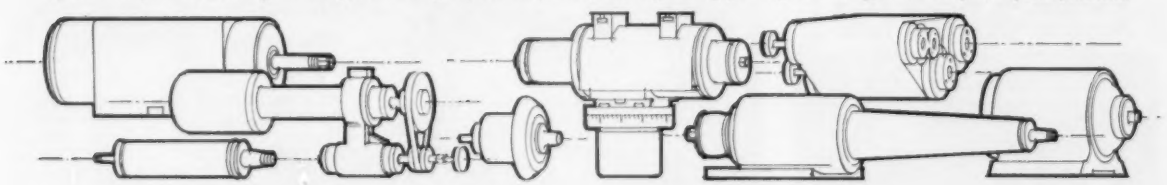




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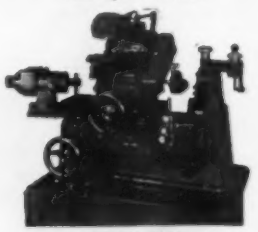
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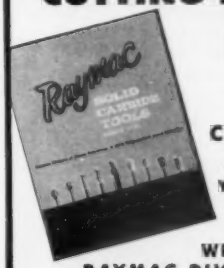
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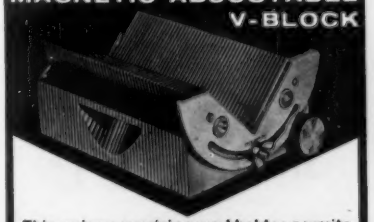


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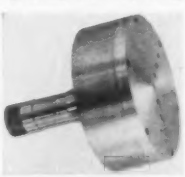
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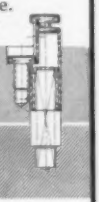
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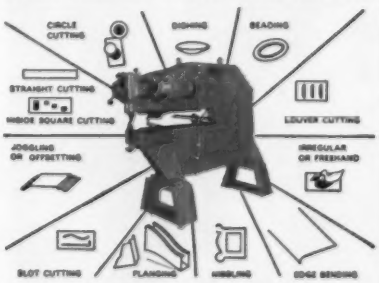
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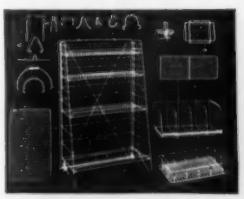
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LOOKING AHEAD

By T. W. Black
Senior Associate Editor

Lockheed chemists have reported development of a cadmium-plating process refinement that makes high-strength steel stronger—and offers appreciable airframe weight reductions.

The process utilizes chemical additives to eliminate the effects of strength-stealing hydrogen gas. Hydrogen produced by water electrolysis during plating is assimilated by introduction of the additive, a nitrate compound, into the bath. The process is currently being used by Lockheed in its own plants and by others under a licensing arrangement.

Steel mills can now be automated from customer order to delivery of finished product, according to Harold A. Strickland, Jr., G. E. vice president. He predicts that an equal degree of automation will follow in other industries in the near future.

G. E. efforts have been concentrated on the development of system elements and equipment to tie together the "islands of automation" now existing in many plants.

Any decision for a particular automation project, say G. E. executives, should be based on a responsible evaluation of expected return on investment. They find that a two-year or even shorter payoff period is reasonable for well conceived automation projects.

A plan to reward its engineers for creative ideas has been announced by Waste King Corp. Monetary awards will be given to engineers (and other employees) who originate new products or programs that are adopted and pursued profitably by the corporation.

Bertram Given, Waste King president, says that he believes that every engineer has creative talents that can be brought out by proper incentives; also that the "creativity awards" will help the corporation attract and retain outstanding engineering talent.

A new type of cutting tool holder, developed by Horace Frommelt and first covered in his article: "Cut 75 percent Faster with Powder Metal Shanks" in the May 1959 issue of this magazine, has now reached the production stage.

Used with carbide, ceramic or cermet throwaway inserts, the holders, of copper-infiltrated powder iron, absorb vibrations that can cause premature failure of inserts held in conventional holders. Also, the infiltrated copper conducts heat from the cutting edge, prolonging insert life. Tool life increase of 400-500 percent have been reported in production tests.

The holders are being produced by Ferro Powdered Metals for single-point turning, milling and cutoff applications.

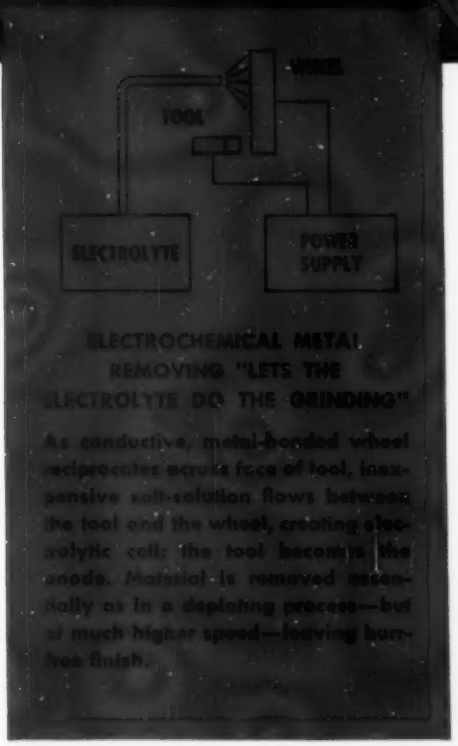
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59-25



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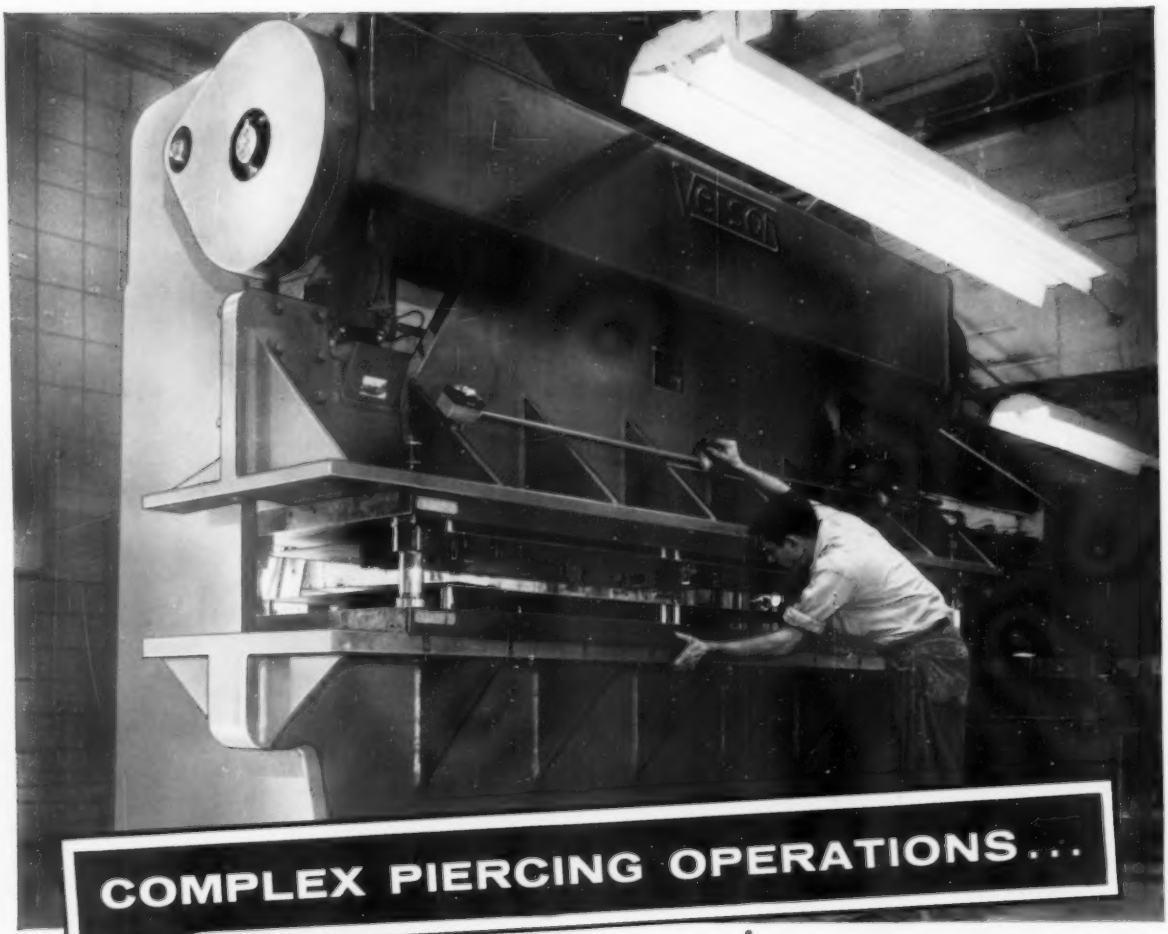
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As an example, the 90 ton Verson Press Brake illustrated above performs complex piercing operations on fluorescent lighting fixture housings for Lighting Products, Inc., Highland Park, Illinois. The tool-up shown simultaneously pierces a number of holes of various sizes and shapes, completing all piercing operations on the 4', 20 gauge housing in a single stroke and a single handling.

When you are examining your production requirements, don't overlook the economy and versatility of Verson Press Brakes. Check the line-up at the right and write for a catalog.

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MAJOR SERIES for the biggest and most demanding jobs . . . the ultimate in mechanical press brake design.

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